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LIFE SCIENCES

BIOMEDICAL AND BEHAVIORAL SCIENCES

No. 3

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UDC 599+5+599.745

SEVENTH ALL UNION CONFERENCE ON OCEAN MAMMALS

Moscow ZOOLOGICHESKIY ZHURNAL in Russian No 12, 1979 pp 1901-1902

[Article by G. B. Agarkov, O. Ya. Pilipchuk]

[Text] The conference took place 20-23 September 1978 in Simferopol'. In the work of the conference, which proceeded in the auditoriums of the Biological Faculty of Simferopol' University, approximately 170 reports were heard out of 274 submitted. Specialists from scientific-research establishments of the USSR Academy of Sciences participated, as well as specialists from academies of union republics, from the Ministry of the Fishing Industry, from higher educational institutions, from national parks, as well as from other departments.

Questions concerning the most important problems of ocean mammals were examined and discussed: phylogy and systematics of pinnipeds and cetaceans, their morphology, ecology, ecological physiology, faunistics and zoogeography, bioacoustics, behavior, and the contemporary condition and prospects of the trade. Great attention was devoted to the economic significance of ocean mammals. Conference participants discussed with particular concern the problem of preservation, regulation of the numbers, and the rational use of ocean fauna. The theses of the reports are published in the collection "Ocean Mammals" (Moscow, 1978, 392 pp.).

At two plenary sessions, 12 reports were given reflecting the development of research into ocean mammal fauna. With great interest the following reports were heard: "General Principies of Control and Preservation of Live Resources as Applied to Ocean Mammals" (A. V. Yablokov), "Ocean Mammals and the Problem of Pollution of the Environment" (D. D. Tormosov), "Successes and Long-Range Trends in the Study of the Functional Morphology of Cetaceans" (G. B. Agarkov, A. P. Manger), "Basic Stages in the Transition from a Trade to an Ocean Trapper Economy" (L. A. Popov, V. N. Mineyev), "A Systemic Approach in Research on the Embryonic Development of Cetacenas" (A. S. Leontyuk), etc. The basic flow of information was presented in five sections: cetaceans, pinnipeds, morphology and physiology of ocean mammals, bioacoustics of ocean mammals, and behavior.

At the conference it was noted that in recent years the numbers of several species of ocean mammals important for trade has noticeably grown or has stabilized. In accordance with new rules (1975) of protection and hunting of ocean mammals, control over the observance of limits and rules regarding the catch of various species has been strengthened.

One of the most pressing scientific and social problems for all countries is the problem of preservation and rational use of natural resources. The preservation and rational use of ocean mammals is extremely important for various branches of the economy, as well as for public health and the satisfaction of cultural and aesthetic requirements of people. On this level the report of A. V. Yablokov deserves special attention, showing as it does that the main general approach to the study of ocean mammals in the future must be a transition from a study of them as a trade to a study of them as an economy in the broad sense of this concept.

Reports about the significance of various species of ocean animals in the life of the ecosystem were important. Predatory ocean mammals are well known as being harmful to the fishing industry, and at the same time are often not only useful, but even irreplaceable members of the biogeocenoses (regulators of numbers and of hygiene and necessary intermediate links in the food chain and energy exchange, etc.). Therefore in papers of conference participants, the role which ocean mammals play in one or another biocenosis was underlined. In this connection, the speeches of conference participants contained questions regarding raising productivity, the rational use and protection of ocean animals, and the scientific justification for the struggle with species which are harmful to the fishing industry. Finally, an evaluation of the knowledge of principles defining the functioning of groups at the population level was given.

The report of G. B. Agarkov and A. P. Manger emphasized the importance of knowledge and of the wide utilization of facts relating to the functional morphology of water mammals, in as much as the majority of the organs important for the life of cetaceans were subjected to adaptation. This in particular involves the organs of locomotion, sound generation, echo location, respiration, blood circulation, and the endocrine system. Regardless of the successes achieved, a pressing problem is the further development of research in this direction, taking into account the integrating influence of the central nervous system.

D. D. Tormosov told of the problems of the pollution of the environment of ocean mammals. The lecturer defined several groups of pollutant substances having a toxic action on live organisms. This includes salts of heavy metals, inorganic substances, herbicides, pesticides, etc.

Questions of the bioacoustics of ocean mammals, their ecology, and behavior occupied a significant place at the conference.

As a whole the reports heard demonstrated a high level of research and elicited great interest from the audience. Creative discussions were carried on.

As at the previous conference with a large group of papers devoted to various aspects of the macroscopic and microscopic structure of internal organs of the nervous and endocrine system in dolphins, scientists of the Institute of Zoology of the Academy of Sciences of the Ukrainian SSR spoke. At the Rostov Medical Institute, goal-oriented investigations of the intraorgan vascular apparatus continue. Research into the embryology of ocean mammals at the Minsk Medical Institute has significantly broadened. Interesting papers were presented by coworkers of the Brain Institute of the USSR Academy of Medical Sciences, the Institute of Evolutionary Morphology and Animal Ecology of the USSR Academy of Sciences, the Institute of Developmental Biology of the USSR Academy of Sciences, and a number of other establishments. Through the efforts of the workers of the Institute of Zoology of the Academy of Sciences of the Ukrainian SSR and of the Moscow University, the problem of chemoreception in dolphins has been resolved.

At the concluding session, the accomplishments of the conference were summed up and the paths of further study of ocean mammals in our country were noted. It was unanimously underlined that the only correct course of really intelligent use of ocean mammals involves widened reproduction and full utilization of production.

The conference accepted a detailed resolution in which the most important achievements of Soviet science with regard to ocean mammals were reflected and in which the paths of its further development were noted.
[552-9193]

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9193
CSO: 1840

UDC 615.339:576.858.095.383].015.4

BIOLOGICAL ACTIVITY OF A NEW SOVIET NATURAL INTERFERON INDUCTOR, DOUBLE-STRANDED RNA

Moscow ANTIBIOTIKI in Russian No 1, 1980 pp 28-32 manuscript received 4 Jul 79

FOMINA, A. N.: GRIGORYAN, S. S.: ZAYTSEVA, O. V.: NIKOLAYEVA, O. V: BUKATA, L. A.: NOSIK, N. N.: FADEYEVA, L. L.: and YERSHOV, F. I., Institute of Virology imeni D. I. Ivanovskiy, USSR Academy of Medical Sciences, Moscow

[Abstract] The tested double-stranded RNA (dsRNA) was supplied by the Institute of Microbiology imeni Kirshenshteyn by extraction from viruses and phages. White mongrel mice were given dsRNA at different times prior to infection with tick-borne encephalitis virus to determine the dynamics of interferon production. The animals developed hyporeactivity after 2 injections of dsRNA, associated with significant decline of blood serum interferon titers. Testing of different doses of inductor revealed that there is a correlation between protective effect and dosage (20 µg was ineffective, 50 µg lowered mortality by 20% and 100 µg by 40%), as well as between protective effect, route and time of administration of inductor prior to infection. In view of demonstration of marked interferon induction and immunostimulating activity, it is suggested dsRNA be further investigated as a promising antiviral agent. Figures 3; references 13: 3 Russian, 10 Western.
[222-10,657]

UDC 547.963.32.07

SYNTHESIS OF OLIGO- AND POLYNUCLEOTIDES. XXVIII. CHEMICAL AND ENZYMATIC SYNTHESIS AND CLONING OF AN ARTIFICIAL BRADYKININ GENE

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 12, 1979 pp 1802-1815

KOROBKO, V. G., DOBRYNIN, V. N., BOLDYREVA, YE. F., SEVERTSOVA, I. V., CHERNOV, B. K., and KOLOSOV, M. N., Institute of Biorganic Chemistry imeni M. M. Shenyakin, Academy of Sciences USSR, Moscow, and GORODETSKIY, S. I., SLYUSARENKO, A. G., KAPELINSKAYA, T. V., LISENKOV, A. F., and DUBININ, N. P., Institute of General Genetics, Academy of Sciences USSR, Moscow

[Abstract] Chemical methods employed for the synthesis of the somatostatin gene (Itakura, K., et al., Science, 198: 1056, 1977) were used for the production of deoxyribonucleotide sequences corresponding to the bradykinin gene. A plasmid vector, designated as pL-1, for the bradykinin gene

was created from plasmid pBR 322 and a 4.4 megadalton fragment of phage lambda-plac5 DNA prepared by EcoRI treatment (which contained E. coli lac operon). Recombinant DNA was created between the pL-1 and bradykinin gene DNA and used for transformation of E. coli HB 101; subsequent isolation of a plasmid (pLB55) in which the bradykinin gene was joined to the distal portion of the lac z gene and was expressed under the control of the lac promoter and lac operator in the HB 101 cells led the production of a bradykinin-beta galactosidase chimera molecule. Bromocyanine cleavage of the latter resulted in release of bradykinin. Tables 2; Figures 8; References 32: 9 Russian, 13 Western.
[163-12172]

UDC 577.158.52+535.372

SPECTROFLUORIMETRIC STUDIES ON CONFORMATIONAL MOBILITY IN THE ACTIVE SITE OF HORSERADISH PEROXIDASE AND ITS RELATIONSHIP TO ENZYMATIC ACTIVITY

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 12, 1979 pp 1843-1853

SAVITSKIY, A. P., UGAROVA, N. N., and BEREZIN, I. V., Moscow State University imeni M. V. Lomonosov, Chair of Chemical Enzymology

[Abstract] In order to study the nature of horseradish peroxidase reaction with negatively charged substrates, use was made of a metal-free analogue consisting of protoporphyrin-apoperoxidase complex which is similar to the native protein in tertiary structure and fluoresces strongly in the red spectrum. Evaluation of the spectral changes in the pH range of 2-6 and the effects of interaction with I^-, $Fe(CN)_6^{4-}$, Cl^-, and Cs^+ led to the conclusion that there is considerable mobility of the protein fragments in the vicinity of the porphyrin molecule, i.e., at the active site. The increase in protein mobility with a decrease in pH is related to an increase in the electrostatic free energy of the protein. Most probably conformational mobility is affected by protonation of a number of carboxyl groups with pK values close to 4.5. Of particular importance is a group with a pK 4.3 to which the addition of a single proton markedly alters protein fluctuation so as to permit access of small molecules to the porphyrin moiety. This group appears to be one of the propionic acid residues on the porphyrin ring. Figures 5; Tables 3; References 30: 15 Russian, 15 Western.
[163-12172]

UDC 576.8.097.29.095.87

PROSPECTS FOR OBTAINING NONTOXIC BACTERIAL ENDOTOXINS

Moscow ANTIBIOTIKI in Russian No 1, 1980 pp 67-73 manuscript received 28 Feb 79

SHOSHIYEV, L. N.; AVROROV, V. P.; and YAGOVKIN, E. A., Rostov Plague Control Institute

[Abstract] There are at least three reasons for decontaminating bacterial endotoxins, generally referred to as lipopolysaccharides (LPS): endotoxins play a significant role in the pathogenesis of infections; possible use of nontoxic endotoxins for clinical and experimental studies; use of detoxified endotoxins for prevention of septic and hemorrhagic shock due to Gram-negative microorganisms. Among such products, pyrogenal and prodigiosan are already in use in clinical practice. Methods of decontaminating endotoxins are described and the most promising ones are evaluated (since the methods used to detoxify exotoxins are not effective for endotoxins): heating, irradiation, chemical and biochemical methods. It is also possible to obtain endotoxins with desired properties. Chemical methods that are considered to be promising include treatment with hydroxylamine, phthalate and succinate, as well as attenuation of detoxified LPS by conjugation with various carriers; promising biochemical methods involve the enzymatic approach. References 67: 21 Russian, 46 Western.
[222-10,657]

UDC 577.153.211.02

MICROCHROMATOGRAPHIC STUDIES ON ASSOCIATION RATE AND EQUILIBRIUM CONSTANTS OF PHOSPHOLIPASE A_2 ISOLATED FROM THE VENOM OF CENTRAL ASIAN COBRA

Moscow BIOORGANICHESKAYA KHIMIYA in Russian No 11, 1979 pp 1710-1719

MAL'TSEV, V. G., ZIMINA, T. M., KURENBIN, O. I., and BELEN'KIY, B. G., Institute of High Molecular Weight Compounds, USSR Academy of Sciences, Leningrad, and ALEKSANDROV, S. L., PAVLOVA, N. P., D'YAKOV, V. L., and ANTONOV, V. K., Institute of Bioorganic Chemistry imeni M. M. Shemyakin, USSR Academy of Sciences, Moscow

[Abstract] Elution patterns of phospholipase A_2 isolated from the venom of the Central Asian cobra (Naja naja oxiana) were studied in a microchromatographic system employing a 25 x 0.1 cm column packed with G-75 fine Sephadex in a pH 7.5 Tris-HCl buffer system to determine the kinetic and equilibrium constants of dimerization. The results showed that in the absence of Ca^{++} the equilibrium constant derived from the kinetic

data was 6 x 10^{-4} M^{-1}, while k_1 = 4.2 x 10^{-4} $M^{-1}sec^{-1}$, and k_2 = 0.7 x sec^{-1}. The presence of 0.02 M Ca^{++} did not affect the equilibrium constant but lowered the association and dissociation constants approximately fourfold, suggesting that Ca^{++} does not participate in stabilizing the active dimeric form of phospholipase A_2. Tables 2; Figures 8; References 27: 10 Russian, 17 Western.
[939-12172]

UDC 577.154.33

NEW ULTRASONIC METHOD FOR INVESTIGATING THE COMPOSITION AND PROPERTIES OF POLYENZYMATIC SYSTEMS: ENZYMES OF THE CELLULASE COMPLEX

Moscow BIOKHIMIYA in Russian No 1, 1969 pp 3-10 manuscript received 18 Jul 79

KLYESOV, A. A. and CHURILOVA, I. V., Chemistry Faculty, Moscow State University imeni M. V. Lomonosov

[Abstract] A new ultrasonic method for determining the composition and properties of discrete components of polyenzymatic systems without their prior separation is described. The method is based on determining the pH dependence of the inactivation rate constants of the discrete components under the action of cavitational untrasound. The method was used to investigate the cellulase complex of the fungus Geotrichum candidum. It is shown that the composition of that complex includes at least four cellulolytic enzymes: endoglucanase, exoglucanase, cellobiase, and aryl-beta-glucosidase. These enzymes display different values of the pK ionogenic groups determining the pH profiles of ultrasonic inactivation, as well as different inactivation rate constants of the active-center shape most resistant to the effect of the ultrasound. The inactivation of the enzymes by the ultrasound acting on their solutions occurs owing to the free radicals then forming in the solution. Thus the ultrasonic method of enzyme inactivation may be a useful complement to the known biochemical and kinetic methods for determining the composition and properties of polyenzymatic systems. Figures 2; references 26: 14 Russian, 12 Western.
[223-1386]

ELECTRON MICROSCOPE STUDY OF DENSONUCLEOSIS VIRUS MATURATION IN MOSQUITOES

Bratislava ACTA VIROLOGICA in Russian Vol 23, No 2, pp 170-172 manuscript received 12 Dec 78

BUCHATSKIY, L. P., and RAYKOVA, A. P., Kiev State University imeni T. G. Shevchenko

[Abstract] A study was made of electron microscope examination of densonucleosis virus maturation in infected larvae cells of bloodsucking mosquitoes A. aegypti L. Some 1st stage larvae of A. aegypti L. were inoculated by means of introducing a homogenate of infected densovirus 4th stage mosquito larvae at the rate of two per Petri dish. Preparations were examined with electron microscope "JDM-100B" at × 50,000, × 30,000 and × 20,000. The first ultrastructural changes in cells appeared 6-8 hours after infection, whereupon these changes were noted in nuclei as well as in cytoplasm. In cytoplasm, destruction was observed of endoplasmic reticulum and various organelles; also, paracrystalline inclusions appeared, consisting of round particles 18-20 nm. With development of the infection, the number of these increased, especially in the first three days. A large number of microtubes were observed between inclusions, observed also in other virus infections. Their diameter was 20 nm; according to Bykovskiy classification they could belong to type B. In hypertrophied nuclei the nucleoli could be divided into fibrillar and granular components, displaced toward the nuclear membrane. Mature virions appeared within virogenic stroma. The exit of virions apparently occurred as a result of cell breakage.
[249-12,152]

UDC 577.3

A POSSIBLE STAGE OF ABIOGENIC MOLECULAR EVOLUTION

Moscow BIOFIZIKA in Russian Vol 25, No 1, Jan/Feb 80 pp 7-12 manuscript received 15 Oct 74 revised 5 Apr 79

Ye. A. KAYMAKOV, Physical Technical Institute imeni A. F. Ioffe, USSR Academy of Sciences, Leningrad

[Abstract] Sublimation of relatively concentrated aqueous solutions leads to formation of porous matrixes composed of microcrystalline residues. Low concentration solutions produce threads during sublimation, probably through the development of spiral dislocations and cumulation of the solute molecules into monomeric sequences of considerable length. Each thread consists of an ice skeleton encapsuled in a molecular layer of the material being sublimed. Experiments in which the sublimation material was illuminated showed that along with sequencing of the molecules, they can

also polymerize, forming biological sublimation constructions - biosublicons. The study of biosublicons opens a new approach to finding the solution of the problem of the appearance of the first biological macromolecules on the planet earth. An individual polycomponent biosublicon consists of an ice skeleton wound with a spiral of interwoven chains of various biopolymers. The skeleton fixes spacial orientation of these chains and provides some stability against mechanical stresses. Formation of biosublicons on earth could have determined the initial genotype of all living things. Figures 4, references 21: 17 Russian, 4 Western.
[266-7813]

RESOLUTION OF THE CPSU CENTRAL COMMITTEE AND USSR COUNCIL OF MINISTERS "ON FURTHER DEVELOPMENT OF MEDICAL SCIENCE IN AREAS OF SIBERIA AND THE FAR EAST"

Moscow SOBRANIYE POSTANOVLENIY PRAVITEL'STVA SSSR in Russian No 23, 1979 pp 527-531

[Resolution No 778 dated 13 August 1979]

[Text] The CPSU Central Committee and the USSR Council of Ministers note that the solution of problems in the steady rise of the material and cultural level of life of the people, advanced by the Communist Party, and the securing of the right of citizens, assured by the new USSR Constitution, to preservation of health must be closely involved with improvement of the work of public health institutions, expansion of scientific research directed toward the prevention and reduction of the incidence of disease and lengthening of the active life of the Soviet people. The further development of medical science is acquiring especially great importance for Siberia and the Far East, where in accordance with the decisions of the 25th CPSU Congress enormous work is being developed on implementation of a program of complex organization of the natural resources of those areas, vitally important for our country.

During the years of Soviet power certain work has been done in those areas on the creation of a network of medical scientific research institutions and VUZ's and on the training of highly qualified cadres of medical scientists. At the present time scientific institutions and VUZ's of the USSR and RSFSR ministries and of the Siberian Department of the USSR Academy of Medical Sciences are engaged in working out questions of medical science here. The Siberian branches of the USSR Academy of Sciences and the All-Union Academy of Agricultural Sciences imeni V. I. Lenin (VASKhNIL) have been drawn in to solve medico-biological and socio-hygienic problems.

At the same time the CPSU Central Committee and the USSR Council of Ministers note that the development of the network of scientific medical institutions and the level and volume of medico-biological investigations in Siberia and the Far East still lag behind the growing needs of the public health service.

Many medical scientific research institutions, and also the Siberian branch of the USSR Academy of Medical Sciences have a weak material and technical base, are not completely staffed with highly qualified scientific personnel and do not participate actively enough in the solution of a number of medical problems, and especially the prophylaxis and therapy of cardiovascular, oncological and occupational diseases, and also of natural focal infections, preservation of the health of the mother and child, environmental hygiene and other questions connected with improvement of the medical care and preservation of the health of the population.

The USSR Ministry of Health and the USSR Academy of Medical Sciences have not adopted due measures to coordinate investigations being conducted by scientific research institutes and medical VUZ's, with consideration of the further intensive development of medical science in the eastern part of the country.

For the purposes of further development of medical science, expansion of scientific research work in the areas of theoretical and clinical medicine and the solution of very important socio-hygienic problems in areas of Siberia and the Far East, the CPSU Central Committee and the USSR Council of Ministers order:

1. The USSR Ministry of Health, the USSR Academy of Medical Sciences, the RSFSR Council of Ministers, kray and oblast committees of the Party and ispolkoms of kray and oblast councils of workers' deputies in Siberia and the Far East to implement a broad program of measures directed toward the further development of medical science. To assure the training of highly qualified scientific personnel for medical scientific research institutes and their rational distribution with consideration of the prospects of development of medical science and the public health service in eastern rayons.

2. Concentration of the efforts of collectives of scientific research institutions of the USSR Academy of Medical Sciences and the USSR and RSFSR ministries of health on all-possible development of basic and applied research on the leading problems of medicine, improvement of the effectiveness of the work of scientific research institutes, intensification of the coordination of their activity and strengthening of their relations with therapeutic and prophylactic institutions.

3. The USSR State Committee for Science and Technology, the USSR Academy of Sciences, the USSR Academy of Medical Sciences and the All-Union Academy of Agricultural Sciences imeni V. I. Lenin jointly with the USSR Ministry of Health and the RSFSR Council of Ministers:

--to prepare long-range plans of complex investigations on the study and further development of medico-biological, socio-hygienic and medical problems of Siberia and the Far East;

-- to carry out a broad program of scientific investigations of wild medicinal plants in order to more completely put the gigantic natural resources of Siberia and the Far East at the service of the health of man.

The RSFSR Council of Ministers to examine questions connected with the creation of special preserves for the conservation of the natural flora of those regions, and also with expansion of the network of farms and enterprises for the production of cultivated medicinal plants.

4. To adopt the proposal of the USSR Ministry of Health and the USSR Academy of Medical Sciences, agreed upon with the USSR State Committee for Science and Technology, the USSR Academy of Sciences and the RSFSR Council of Ministers, to transform the Siberian branch of the USSR Academy of Medical Sciences and its institutes into the Siberian department of the USSR Academy of Medical Sciences. To establish that the Siberian department of the USSR Academy of Medical Sciences be subordinate to the USSR Academy of Medical Sciences and the RSFSR Council of Ministers and be financed separately in the RSFSR budget.

The USSR Gosplan and the RSFSR Council of Ministers to examine the question of consolidating the material and technical base of the medical scientific research institutes and scientific subdivisions of medical VUZ's situated in Siberia and the Far East.

5. That the Siberian department of the USSR Academy of Medical Sciences accomplish the planning, coordination and forecasting of scientific investigations conducted by medical scientific institutions and medical VUZ's of Siberia and the Far East on the most important problems of medicine, and to prepare proposals on their inclusion in the state plan of economic and social development of the RSFSR.

6. The USSR State Committee for Science and Technology, jointly with the RSFSR Council of Ministers and the USSR Academy of Medical Sciences:

--to examine questions of the organization within the Siberian department of the USSR Academy of Medical Sciences of scientific research institutions for problems of pulmonology, surgery, endocrinology, medical genetics, immunology and biochemistry, and also of a branch of the All-Union Scientific Center of Cardiology of the USSR Academy of Medical Sciences;

--to take into consideration the decision of the USSR State Committee for Science and Technology regarding the creation in Tomsk of a branch of the Oncological Scientific Center of the USSR Academy of Medical Sciences;

--to examine in the established procedure the question of transfer of scientific research institutions to the Siberian department of the USSR Academy of Medical Sciences.

7. Adoption of the proposal of the USSR Ministry of Health and the USSR Academy of Medical Sciences, agreed upon with the USSR Gosplan and the RSFSR Council of Ministers, regarding the construction in the years 1981-1990 of the Institute of Physiology, a library and a medical school (Novosibirsk), the Institute of Medical Problems of the North (Krasnoyarsk), a laboratory

of Polar medicine (Noril'sk), the Institute of Complex Problems of Hygiene and Occupational Diseases (Novokuznetsk) and the Institute of Protection of Motherhood and Childhood (Khabarovsk) in accordance with the appendix [which does not accompany the resolution].

The USSR Gosplan to make provision, starting in 1980, in the drafts of state plans for the economic and social development of the USSR, for the allocation to the RSFSR Council of Ministers for the Siberian Department of the USSR Academy of Medical Sciences of the necessary capital investments and to determine the contracting and planning organizations to assure the planning and construction of the facilities indicated in the appendix.

The Krasnoyarsk and Khabarovsk kraykoms of the CPSU and krayispolkoms and the Kemerovsk and Novosibirsk obkoms of the CPSU and oblispolkoms to establish systematic control of the course of construction and the introduction into operation in the established periods of facilities of the Siberian department of the USSR Academy of Medical Sciences.

8. To improve the scientific and technical information about the development of medical science and the public health system in rayons of Siberia and the Far East to authorize the USSR Ministry of Health and the RSFSR Council of Ministers to organize, starting in 1981, the publication of the Bulletin of the Siberian Department of the USSR Academy of Medical Sciences with a volume of 42 printed sheets per year and a periodicity of publication of 6 times per year.

9. To adopt the proposal of the USSR Ministry of Health and the USSR Academy of Medical Sciences on increase of the number of vacancies of academicians of the USSR Academy of Medical Sciences by five and of corresponding members by 10 to fill up the staff of the Siberian department of the USSR Academy of Medical Sciences.

10. The USSR State Committee for Science and Technology, the USSR Gosplan and the USSR Ministry of Finance to increase for the RSFSR Council of Ministers for 1980 and following years the plan of financing of scientific research work, and also the wage fund and appropriates from the budget needed for the financing of the presidium of the Siberian department of the USSR Academy of Medical Sciences and new scientific research institutions that are being organized.

The CPSU Central Committee and the USSR Council of Ministers express confidence that the kray and oblast committees of the Party and the ispolkoms of kray and oblast councils of people's deputies, ministries and departments and the collectives of scientific medical institutions and medical VUZ's will undertake the necessary measures for the further development of medical science and elevation of the level of the public health service in rayons of Siberia and the Far East.

Secretary of the CPSU
Central Committee
L. Brezhnev

Chairman of the USSR
Council of Ministers
A. Kosygin

Moscow, the Kremlin, 13 August 1979, No 778
[178-2174]

2174
CSO: 1840

UDC 614.2(47-87)(082)(049.32)

WORLD PUBLIC HEALTH LECTURES PUBLISHED

Moscow SOVETSKOYE ZDRAVOOKHRANYENIYE in Russian No 10, 1979 pp 67-68

[Review by RSFSR Distinguished Scientist, Prof S. Ya. Freydlin of the book "Aktual'nyye problemy zarubezhnogo zdravookhraneniya (sbornik lektsiy)" (Pressing Problems in Foreign Public Health (Collection of Lectures)) edited by O. P. Shchepin, Moscow, Central Order of Lenin Institute for the Advanced Training of Physicians, 296 pages]

[Text] The program of instruction for social hygiene and public health organizations foresees acquainting the students with the status of public health in various foreign countries. The study of this topic has recently been difficult due to the absence of any sort of training aids. The book under review here is intended to correct this omission. It begins with a review of the demographic situation and provides a prediction up to the year 2000. Average annual population growth is shown to fluctuate (from 0.5-1.0 percent in developed countries to 3.5-4.0 percent in developing countries). Population growth, the collection notes, is the result of complex interaction of demographic processes with a complex of economic, social, biological, legal, cultural, ethnographic, and other factors in the concrete conditions of each country at the given stage of its development.

The authors validly emphasize that if we are to assess reproductive processes in the population and solve a number of important socioeconomic and national economic problems, it would be highly important for us to acquire information on the age-sex structure of the population; the book devotes a great deal of room to analyzing these materials in different countries.

We would have to agree with the authors that owing to the extreme complexity with which factors influencing birth rate interact, a universally acceptable classification of these factors is still nonexistent. All that we can accept for the moment is that the level of economic development of the countries and specific regions is the main factor, one which in turn predetermines welfare and the level of general and cultural development.

One of the most important sociodemographic indicators characterizing the medical status of the population is mortality. Total mortality is highest in developing countries, while in economically developed countries it is relatively low. Mortality differs significantly in different population groups depending upon age and sex. In most countries of the world mortality is higher among men.

The authors of the lectures are fully justified in treating child mortality as the most important demographic indicator, one characterizing the medical status of the population in the most accurate way. Child mortality is highest in developing countries of Asia, Africa, and Latin America. It is much lower in economically developed countries. The authors validly assert that perinatal mortality has special significance as an indicator of child mortality. Its level is stated for different countries, and its causes are analyzed. The nature and structure of the causes of child mortality in economically developed and in developing countries have their own unique features.

Maternal mortality is extremely high in developing countries, as a rule exceeding that in economically developed countries by several orders of magnitude.

The authors of the lectures quite correctly interpret the concept of mean life span in different countries.

This lecture ends with recommendations on implementation of a scientifically grounded demographic policy, particularly on measures to regulate the rate of natural population growth in developing countries at a particular stage of their development. However, these measures must be viewed only as being auxiliary. Every country must make a maximum effort to mobilize all of its internal forces to fundamentally alter its economy and culture, with a consideration for the concrete situation.

A separate lecture goes into very great detail on the consequences of imperialist dominance in Africa in public health. Following a description of the economic conditions enjoyed by the population, the authors dwell on the grave housing conditions, on the absence of elementary public health measures, and on the poor status of water supply and sanitary treatment of population centers.

The food problem is analyzed from all aspects. Estimates made by the authors show that if we are to significantly raise the food consumption norms in developing countries, by the year 2000 the available food must exceed the present food availability in these countries by a factor of four, with a consideration for population growth.

Conservative customs, various religious and personal predjudices, and tribal taboos are an important cause of malnutrition and protein deficiency, particularly in regions affording adequate conditions for raising meat and dairy animals.

The next section contains lectures devoted to the health of the population and the status of public health in Africa. After presenting figures on population density and the age-sex structure, and after providing a general description of the population structure, the authors discuss the problems of migration and urbanization and provide a detailed analysis of the birth rate and mortality of populations in individual African countries; the authors also present the mean life span indicators and an expanded demographic forecast. However, as the authors themselves mention, these forecasts are not highly reliable, since they are based on insufficiently significant raw statistics. A general trend toward lower population growth in 1995-2000 can be seen. Complications elicited by rapid population growth are encouraging more and more governments to include population control measures in their national development programs. The problems of population control in developing countries are an object of serious scientific debates and acute ideological conflicts. The authors of the lectures are entirely correct when they assert that compulsory birth control would be unable to eliminate the action of factors responsible for a high birth rate. On the other hand they quite validly believe that rejection of the suitability of birth control measures is the product of assuming a simplistic point of view. A desire to regulate population growth in the interests of economic development, the book states, is fully justifiable.

A section on public health organization in African countries shows that different paths of development have been assumed in this regard, private in some countries and state-sponsored in others. At the moment both categories of African countries have both private and state medical institutions.

A special lecture of the book is devoted to public health in the Algerian Peoples Democratic Repuolic. The USSR has been sending more medical specialists to this country than to other African countries.

The general geographic data in the book are followed by a rather detailed description of the demographic situation. Birth rate and mortality figures are given, and a section on morbidity is included. There are permanent centers of acute infectious diseases in Algeria. They are responsible for periodic epidemic outbreaks.

The material-technical base and organization of public health are described in detail.

A special lecture provides an analysis of public health in 10 countries of Southeast Asia with a total population of more than 870 million. The unfavorable public health statistics of these countries are noted. A certain amount of caution must be taken when evaluating a particular situation or when utilizing dissociated, fragmentary, and frequently incomparable information acquired from different sources.

Public health in Latin American countries is described rather fully. Absence of unity and planning are typical. Medical institutions are administered by many organizations--government, social, benevolent, insurance, religious and, finally, private commercial associations and individuals. The state hospital fund of most Latin American countries is unsatisfactory.

A separate lecture is devoted to the health of the population and the organization of public health in European socialist countries. The demographic situation, population morbidity, its physical development, the fundamental principles followed in organizing the public health service, outpatient care, and hospital treatment are analyzed. A clear tendency toward larger hospitals and higher output capacity in the hospitals can be noted in all of these countries.

A special lecture is devoted to the status of public health in economically developed capitalist countries.

The lecture "From the History of Multilateral International Cooperation in Medicine" is interesting. Medicine has been international since the most ancient times. The International Medical Conference held in Paris in 1851 had important significance to international activities aimed at preventing epidemics and especially dangerous infections, and at controlling them; the writing of public health conventions was initiated at this conference. Ten such conferences were held during the 19th century.

A special section deals with the origin and activities of the World Health Organization.

Finally the last lecture gives the details of the public health activities of UNICEF. The objective, functions, political and administrative structure of the Children's Fund, its budget and financing, its program of activities, and public health training are discussed.

Thus the collection of lectures presents material embracing all aspects of public health organization in almost all countries of the world. It should elicit broad medical interest.
[516-11004]

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CSO: 1840

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50TH ANNIVERSARY OF THE BRAIN INSTITUTE OF THE ACADEMY OF MEDICAL SCIENCES USSR

Leningrad ARKHIV ANATOMII, GISTOLOGII I EMBRIOLOGII in Russian No 10, 1979
pp 72-74

[Article by V. V. Amunts]

[Text] The Brain Institute was established in 1928. In 1954 it was incorporated into the system of the Academy of Medical Sciences USSR [AMS USSR].

The Institute is an establishment devoted to developing problems of importance in the theory and practice of medicine. Research at the Institute is centered on the development of current problems in modern neurology, the solution of which is not only of general theoretical significance but also important in formulating a weltanschauung and in the further development of neuropathology, neurosurgery, psychiatry, and psychology.

During its first years the Institute was headed by Oskar Fogt, who was recruited by the Soviet Government from Germany, and later by S.A. Sarkisov, Academician of the AMS USSR. S.A. Sarkisov served as director of the Institute for 36 years (from 1932 to 1968). From 1969 to 1973 the Institute was headed by Professor G. D. Smirnov; since 1973 it has been directed by O.S. Andrianov, corresponding member of the AMS USSR.

Outstanding neuromorphologists have worked at the Institute, such as Professor I.N. Filimonov, Academician of the AMS USSR, Honored Scientist Professor Ye.P. Kononova, laureates of the State Prize of the USSR V.V. Portugalov, corresponding member of the AMS USSR, and Professor G. I. Polyakov, Professor P. Ye. Snesarev, S. M. Blinkov, M. M. Kurepina, N.S. Preobrazhenskaya, L.A. Kukuyev, I.A. Stankevich, and others, as well as such neurophysiologists as Academicians P. K. Anokhin and M.N. Livanov, full member of the All-Union Agricultural Academy imeni Lenin N.F. Popov, laureate of the State Prize of the USSR B.N. Klosovskiy and V.S. Rusinov, Professor L.G. Trofimov, and others.

Currently the Institute is composed of eleven laboratories: brain architectonics, neuroanatomy, neuronal brain structure, brain ultrastructure, biohistochemistry, morphophysiology of the conditioned reflex, neuronal mechanisms of closed-circuit brain function, neurocybernetics, functional synaptology, functional morphology and pathohistology, and a museum of brain evolution.

Research at the Institute is devoted to general and special aspects of the structure-function problems of the brain, and the problems of reorganization in pathology and altered functional states.

During the fifty years of the Institute's existence the Soviet school of architectonics was founded which approaches brain research from the general viewpoint of the theory of evolution as enunciated by S.A. Sarkisov, I.N. Filimonov, Ye.P. Kononova, and G.I. Polyakov. A rational classification has been developed for the cytoarchitectonic formations and the types of cortical neurons in the human brain, and a description has been provided of the principles underlying structural organization, development, and ranking in the phyloontogenesis of the various systems of the brain.

At the present time the brain architectonics laboratory--which is headed by Doctor of Medical Sciences T.A. Leontovich--is concerned with the topographic distribution in the brain of various types of neurons and has developed an original method for their quantitative analysis.

Professor S. B. Dzugayeva, Honored Scientist of the RSFSR and head of the neuroanatomy laboratory, supervises studies on the conducting pathways in the human brain from the phylogenetic and ontogenetic point of view. New and original underlying principles have been uncovered for the structural organization of the conducting pathways of the brain: the presence in the analyzer system of direct receptor-cortical and receptor-cerebellar pathways which increase in human phylogenesis, alongside switching mechanisms.

The use of electron microscopy, which was initiated by Professor N.N. Bogolepov, has made possible a morphologic investigation of the finest physiological and pathological neuronal mechanisms and interneuronal connections. A hypothesis has been advanced on different "informative" and "reliable" interneuronal contacts based on ultrastructural differences.

The biohistochemistry laboratory, which has been headed for many years by Professor V.V. Portugalov, Corresponding Member of the AMS USSR, and subsequently by Professor Z.D. Pigareva, has provided information on basic chemoarchitectonics (based on unique features of protein, energy, and specific tissue metabolism) and biochemical differences in the analyzer systems of the brain from the viewpoint of brain onto- and phylogenesis. Extensive studies are presently being conducted on deprivation of visual function.

The first studies on cortical biocurrents in the cerebral hemispheres were conducted by M.N. Livanov, P.K. Anokhin studied systemogenesis at the Brain Institute.

Professor N.N. Lyubimov and others are currently engaged in the neurocybernetic aspects of brain research. Studies have already been conducted on multichannel conduction of afferent excitation in the analyzer (sensory) systems of the brain and of the mechanisms underlying this phenomenon. Certain concepts have been formulated for the structure-function units responsible for transmission and transformation of excitation, which are characteristic of the nervous center as a whole.

Certain concepts have been formulated on the basis of brain structure that provide a structural basis for the various forms of the conditioned reflex. A distinction has been made between the horizontal and vertical systems involved in integrative activity. A new set of principles has been advanced to explain thalamocortical and interocortical interactions (O.S. Adrianov et al.).

Doctor of Biological Sciences V.G. Skrebitskiy and others are studying synapse function and synaptogenesis in the various brain structures. Particular attention is accorded to functional plasticity exhibited by synapses, which are responsible for memory and learning, as well as to the principles which underlie synapse formation, neuronal differentiation, and the differentiation of neuronal extensions. Tissue cultures of nervous tissue provide a convenient system for studying differentiation. The latter studies are being conducted by Candidate of Medical Sciences I.V. Viktorov.

Electrophysiologic studies on the brain at the Institute are being developed by Doctor of Medical Sciences M. Ya. Rabinovich and others. By means of intracellular electrodes a description has been obtained of the convergence of various afferent stimuli on the neurons of the cerebral cortex. An analysis of the mechanisms of formation and reproduction of temporal connections at the cellular and synaptic levels has made possible a clearer understanding of the signal-determined and centrally-determined forms of the conditioned reflexes.

Honored Scientist of the RSFSR Professor A.A. Volokhov and others have investigated the fundamental aspects of the formation of congenital reflexes and conditioned reflexes in the ontogenesis of animals and in young children. These studies led to the concept of a stage-wise development of neural activity which supports and expands the views of the founders of Soviet physiology I.P. Pavlov and L.A. Orbeli regarding the evolution of the nervous system.

Fine mechanisms of action of a number of neurotropic agents have been elucidated, which are currently used in neurology and psychiatry at the system and cellular levels. Morphological studies on adaptive changes in the CNS have increased the number of structural changes which are correlated with functional and compensatory processes (Doctor of Biological Sciences E. N. Popova and others).

Studies are being conducted on the effects of toxic factors on the brain. Disturbance in brain development of the fetus have been correlated with homeostatic disturbances in the maternal organism involving a small excess of thyroidin and asphyxia (Doctor of Biological Sciences Ye.N. Kosmarskaya and others).

In recent years, on the basis of his own research and that of others at the Brain Institute of the AMS USSR, O.S. Adrianov has advanced a concept on the systemic organization of cerebral functions. According to this concept, function is based on a complicated interaction at a given level among various brain systems (projectional, associative, integrative-release, limbico-reticular, and others). The pathways and mechanisms of this interaction are predicated on the modality and complexity of the efferent signal to a specific response which is based on previous experience, level, and nature of motivation. Their dynamic nature is apparently based on the behavioral, neuronal, synaptic, and, evidently, molecular levels of organization. Despite the functional heterogeneity of brain structures, each formation or system of formations has primary responsibility for some fundamental, genetically determined, functions.

The modern period at the Institute is characterized by new vigor in research: a combined morphological, physiological, and biochemical approach to the organization of the brain. At the Institute emphasis is placed on studies on the human brain and clinical application.

A museum devoted to the evolution of the brain has been active at the Institute since its founding. The exhibits are devoted to evolutionary development. The museum is directed by Doctor of Medical Sciences V.P. Zvorykin and is doing much to popularize knowledge about the brain and in illuminating the evolutionary and methodological aspects of the structure-function organization of the brain.

Currently the Institute engages the services of 21 Doctors of Science and 43 Candidates of Sciences. The publications produced by the Institute during the past fifty years have included 41 monographs, a number of which have been translated abroad, 21 collected works, and four atlases which reflect various aspects of studies on the structure-function organization of the brain.

Thus, during these years the Brain Institute of the AMS USSR has been successfully involved in morphologic, biohistochemical, physiological, and cybernetic studies on the brain with emphasis on phylo- and ontogenesis of animals and humans. Workers at the Institute have prepared a classification of the architectonic formations and neurons, a topographical map of pathways in the human brain, collected comparative cytoarchitectonic and quantitative data on the various brain systems, developed chemoarchitectonics of the neurons, synapsoarchitectonics, studied the development of nervous elements in tissue culture and their ecomorphologic features and organization. Complicated physiologic methods have been utilized to elucidate the functional organization of various systems of the brain.

The research delineated above promotes a better understanding of the systemic organization of cerebral functions and of the mechanisms of compensatory and adaptive human responses. They are of theoretical and practical importance in Soviet public health.

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BONAPHTHONE - A BROAD SPECTRUM ANTI-VIRAL AGENT

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian No 2, 1980 pp 208-212

KURNAYEVA, V. P., PROYNOVA, V. A., PONOMAREVA, V. L., AYZINA, N. L., SHMELEVA, YE. V., PERSHIN, G. N., and SHASHKINA, L. F., Department of Toxicology, Institute of Labor Hygiene and Occupational Diseases, Academy of Medical Sciences USSR, The All-Union Scientific Research Institute of Pharmaceutical Chemistry imeni S. Ordzhonikidze (AUSRIPC), Moscow, and the Kupavna Branch of the AUSRIPC, Moscow Oblast

[Abstract] Trials were conducted on the transplacental transfer of bonaphthone-^{14}C (BP: Bonafton) in Wistar rats in various stages of gestation following intravenous administration of this broad-spectrum antiviral agent. The results showed that only minimal quantities of radioactive BP crossed the placental barrier, with the maximum amount of transfer occurring in the final trimester of pregnancy (0.55% of the administered dose). Most of the injected BP was localized in the fetal membranes which, therefore, exhibited a definite barrier function with respect to this drug. Tables 1; Figures 1; References 8: 1 Polish, 7 Russian.
[301-12172]

UDC 615.281.8.099

TOXICOLOGIC INVESTIGATIONS ON A NEW ANTIVIRAL AGENT 5-BROMOURIDINE

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian No 2, 1980 pp 205-208

BIKBULATOV, R. I., PAPILOVA, YE. I., BRAGINSKIY, D. M., PODGORNAYA, G. V., and DEMIDOVA, S. A., Institute of Virology imeni D. I. Ivanovskiy, Academy of Medical Sciences USSR, and the Municipal No 1 Infectious Diseases Hospital, Moscow

[Abstract] 5-Bromouridine (5-BU), a new antiviral agent effective in the treatment of herpetic lesions in various animals and in clinical trials on herpetic keratitis, was evaluated for toxicity on intraperitoneal, intravenous, per os, and topical application in mice and rabbits. Employing dosages ranging from ten to 300-fold greater (on a weight basis) than those used in human trials, demonstrated that 5-BU was free of any detectable toxic effects in terms of blood chemistries and histopathologic examinations. It is recommended that the drug undergo further studies with the view of early implementation in clinical practice. Tables 1; references 6: 2 Western, 4 Russian.
[301-12172]

UDC 615.214.32.015

PHARMOCOLOGIC STUDIES ON INKAZAN--A NOVEL SOVIET ANTIDEPRESSANT

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian No 2, 1980 pp 133-137

ANDREYEVA, N. I., and MASHKOVSKIY, M. D., Pharmacology Laboratory, All-Union Scientific Research Institute of Pharmaceutical Chemistry imeni S. Ordzhonikidze, Moscow

[Abstract] Mice and rats were employed in pharmacologic testing of a new Soviet antidepressant, inkazan [sic] (3-methyl-8-methoxy-3H,1,2,5,-6-tetrahydropyrazyno(1,2,3-ab)-beta-carboline hydrochloride), which demonstrated that this drug attenuated the depressive effects of reserpine and tetrabenazine, and potentiated the central effects of L-DOPA, 5-hydroxytryptophane, and amphetamine. In distinction to the tricyclic antidepressants inkazan does not posses central cholinolytic effects and shows limited short-term inhibition of serotonin and tyramine deamination in the brain, kidneys, liver, and heart of rats. LD_{50} values on intravenous, subcutaneous, and intragasttic administration to mice were 85, 250, and 445 mg/kg, respectively. Clinical studies demonstrated that inkazan is most effective in patients with moderate, neurotic, apathetic, and hypochondriac depressions, and less effective in patients with deep endogenous depressions. Tables 6; Figures 1; References: 4 Russian. [301-12172]

UDC 615.225.1

PHARMACOLOGIC PROPERTIES OF ADITSIN--A SOVIET ALPHA-ACETYLDIGITOXIN PREPARATION

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian No 2, 1980 pp 170-177

BELOVA, L. F., SOKOLOV, S. Ya., ARZAMASTSEV, Ye. V., ALIBEKOV, S. D., MIRONOVA, M. I., GARBUZOVA, V. M., and KUZNETSOV, Yu. B., Pharmacology Laboratory and the Section of Toxicology and Biological Control, All-Union Scientific Research Institute of Medicinal Plants, Moscow

[Abstract] Comparative pharmacological and toxicological studies were conducted on a Soviet preparation of alpha-acetyldigitoxin, aditsin [sic], and a commercially available Hungarian preparation (Acedoxin, "Gedeon Richter"), employing in situ systems involving cats, frogs, and rabbits, and isolated frog heart preparations. Aditsin was obtained by enzymatic hydrolysis of lanatoside A which was isolated from the leaves of Digitalis lanata Ehrh., c. Scrophulariaceae. The results showed that aditsin possesses potent digitalis-like effects, increasing the amplitude of cardiac contractility 1.7-2.9 fold, and that its ino- and tonotropic effects,

as well as negative chronotropic properties exceeded 3 h under the experimental conditions employed. Since aditsin behaves identically to acedoxin in terms of pharmacologic and toxicologic properties, rates of elimination, and cumulative characteristics, it may be recommended as a substitute for the currently imported acedoxin. Tables 3; Figures 2; References 27: 12 Western, 15 Russian.
[301-12172]

UDC 616.21:615.779.94

STABILIZED ENZYMES AND PROSPECTS FOR USE THEREOF IN OTOLARYNGOLOGY (SURVEY)

Kiev ZHURNAL USHNYKH, NOSOVYKH I GORLOVYKH BOLEZNEY in Russian No 6, 1979 pp 72-76

VEREMEYENKO, Prof K. N., and KARPENKO, G. F., candidate of biological sciences, laboratory of biochemistry (headed by Prof K. N. Veremeyenko), Kiev Scientific Research Institute of Otolaryngology imeni A. I. Kolomiychenko

[Abstract] Enzymes and inhibitors thereof have been found to have therapeutic properties (proteases, nucleases, mucopolysacharides), wider use of which is precluded by the fact that many are unstable and rapidly inactivated, they are uniformly distributed in blood and tissues so that selective targets are not reached, etc. To overcome these problems new techniques are being developed for modification and stabilization thereof involving physical (adsorption, containment in gel, microencapsulation) and chemical methods (use of proper vehicle, formation of covalent bond). The various applications of stabilized ["immobilized"] enzymes are discussed: treatment of suppurative-inflammatory processes, infections, thrombosis, fibrinolysis, use in oncology (asparaginase) and in otolaryngology (sinusitis, surgical laryngology, carcinoma of the larynx, treatment of postoperative wounds and radiation complications, other malignant neoplasms of the ear, nose and throat, allergic involvement of the upper respiratory tract). References 31: 21 Russian, 10 Western.
[275-10,657]

UDC 615.385.1.014.413

QUALITY OF ERYTHROCYTES STORED FOR 12-15 YEARS AT -196° C

Moscow PROBLEMY GEMATOLOGII I PERELIVANIYA KROVI in Russian No 1, 1980
pp 8-11 manuscript received 11 May 79

VINOGRAD-FINKEL', Prof F. R.; FEDOROVA, L. I., doctor of medical sciences; SEMENOVA, N. V.; RYAPOLOVA, I. V.; BORZOVA, L. V.; BATASHOVA, T. V.; AGRANENKO, Prof V. A.; and KOZINETS, Prof G. I., Department of Blood Preservation and Transfusiology (headed by Prof V. A. Agranenko) and Laboratory of Hemocytology and Experimental Chemotherapy of Leukemia (headed by Prof G. I. Kozinets), Central Institute of Hematology and Blood Transfusions (director: Prof O. K. Gavrilov, corresponding member of the USSR Academy of Medical Sciences), USSR Ministry of Health, Moscow

[Abstract] In vitro and in vivo studies were made of biochemical, morphological and functional properties of erythrocytes thawed after storage in liquid nitrogen for 12-15 years, as related to agents used to protect the erythrocytes (acid glucose-citrate solution of the Central Institute of Hematology and Blood Transfusions [CIHBT] No 7b, solution No 11_3 containing 10 vol.% glycerin and lactase and No 11_4 with 30 vol.% glycerin in 0.7% saline with 4% mannitol, the latter being a more refined solution developed at CIHBT yielding a higher percentage of reconstituted cells after thawing). Data are given on number of discocytes, spherical erythrocytes and other forms as related to storage time. The findings indicate that erythrocytes preserved by the CIHBT method retained viability, metabolic and functional activity, and adequate stability after storage for up to 15 years. Figures 3; references 4: 2 Russian, 2 Western.
[220-10,657]

UDC 617.741-089.87-089.84

USE OF SOVIET-MADE POLYETHYLENE SUTURES IN CATARACT MICROSURGERY

Odessa OFTAL'MOLOGICHESKIY ZHURNAL in Russian No 7, 1979 pp 440-441

GOLYCHEV, V. N., SMELOVSKIY, A. S., SEREGINA, T. N. and KRUGLOV, V. D. Department of Ophthalmology, Kalinin Medical Institute; Laboratory of Polyolefin Fibers, All-Union Scientific Research Institute of Synthetic Fibers, Kalinin

[Abstract] The polyethylene sutures (40 microns in diameter) were biologically inert and weaker, less flexible, but more stretchable than polypropylene sutures. They were tested in continuous sclero-scleral sutures in 96 patients (100 eyes) during microextraction of cataracts (93 senile cataracts, 7 complicated cataracts). The new sutures were

easy to use; their good stretchability compensated for the weakness. Suture ends covered by the conjunctiva sometimes emerged, but there were only six complaints of discomfort. In these patients, the sutures were adjusted and cut 8-10 days after surgery. The polyethylene was well tolerated by others with no evidence of local hyperemia of edema in the sclera or conjunctiva. Eyes became quiescent 9.1±0.36 days after surgery. The number of bedrest days was 17.3, which was 1.7 days less than with the use of polypropylene sutures. Visual acuity ranged from 0.5 to 1.0 in 61 eyes and 0.1-0.4 in 59 eyes. Glaucoma and retinal and optic nerve pathology had a detrimental effect on the outcome. A 1-2-year follow-up indicated that the polyethylene was tolerated well by the eye; the eyeball remained quiescent; there were no inflammatory or dystrophic changes. Visual acuity was an average of 0.68±0.034. References 4: 4 Russian. [136-9307]

UDC 616.74-001.29-085.849.19

EFFECT OF HELIUM-NEON LASER ON THE POSTRADIATION RECOVERY PROCESS IN SKELETAL MUSCLE TISSUES

Moscow BYULLETEN' EKSPERIMENTAL'NOY BIOLOGII I MEDITSINY in Russian No 2, 1980 pp 222-224 manuscript received 24 Jun 79

IL'YASOVA, Sh. G. and POPOVA, M. F., Moscow, Institute of Evolutionary Morphology and Ecology of Animals imeni A. N. Severtsev, USSR Academy of Sciences

[Abstract] The beams of helium-neon lasers are known to facilitate the recovery of x-irradiated muscles. However, the mechanism of the stumulating effect of red laser beams on regenerative processes in irradiated and autografted muscle tissues remains unclear. To clarify this mechanism, three series of experiments were conducted on the gastrocnemium (calf) muscle of the rat. In the first series, entire muscles were autografted. In the second series, autografting of the muscles was preceded by irradiation of both hind limbs with a dose of 1000 R. In the third series, x-ray irradiation with the same dose was followed by 10-day long treatment of the hind limbs with helium-neon laser, followed by autografting of the muscles. Transplantation regeneration was analyzed histologically after 2 weeks, 1 month, and 2 months. It was established that laser therapy (wavelength >632.8 nm) produces the best results when applied before rather than after autografting the muscle. Since that is so, the recovery of activity in the transplanted muscle must be regarded as due to the salutary effect of laser beams on the postradiation reparation of all the tissues of the muscle rather than solely to the elimination of the muscle elements that were most damaged by x-rays. It is assumed that the cold light of the helium-neon laser intensifies energy processes in cells, contributing to the formation of ATP which directly participates in the

postradiation reparation of membrances, chromosomes, and other organelles of the damaged cells, as well as in the recovery of their functional properties. Figure 1; references 9: all Russian.
[248-1386]

UDC 617.001.17-06:616-001.36]-07:616.12-008.3+616.153.1-07

HEMODYNAMICS AND LYSOSOMAL HYDROLASES IN SEVERE BURNS

Moscow PATOLOGICHESKAYA FIZIOLOGIYA I EKSPERIMENTAL'NAYA TERAPIYA in Russian No 1, 1980 pp 31-36

KOCHETYGOV, N. I., REMIZOVA, M. I., and KULIKOV, A. M., Experimental Pathology Laboratory, Leningrad Scientific Research Institute of Hematology and Blood Transfusion

[Abstract] Investigations on rabbits and dogs demonstrated that severe burns (40% body area in dogs and front paws in rabbits) were accompanied by marked hemodynamic changes (depressed arterial blood pressure, decreased minute circulatory volume, depressed stroke volume, decreased myocardial contractility, elevated plasma cathepsin D levels). In order to test the hypothesis that the acidosis and hypoxia resulting from the hemodynamic alterations destabilized lysosomal membranes and further aggravated the severity of the shock through release of lysosomal hydrolases, control rabbits received intravenous injections of lysosomal enzymes obtained from 30-35 g of healthy hepatic rabbit tissue. The animals developed hemodynamic changes analogous to those evidenced by dogs and rabbits that had sustained severe burns, confirming the hypothesis with respect to the involvement of lysosomal hydrolases in the pathogenicity of shock. Tables 3; References 17: 7 Russian, 10 Western.
[278-12172]

UDC 616-006

CURRENT STATE AND PERSPECTIVES OF THE ONCOLOGIC SERVICE IN THE USSR

Leningrad VOPROSY ONKOLOGII in Russian No 1, 1980 pp 7-17

SAFONOV, A. G., Moscow

[Abstract] A survey is presented of the oncologic services rendered to the population of the USSR in light of the decisions and directives of the CC of the CPSU and the Council of Ministers USSR issued on September 22, 1977 on "Further Improvements in Public Health". Evaluation of the data clearly demonstrates that while the number of specialized hospitals and

dispensaries providing medical care for cancer patients has increased dramatically over the past decade, the overall statistics on cancer morbidity and mortality show a gradual increase. This is partly due to increase in the general population, its age, and more efficient diagnosis. Significant differences prevail among the different regions of the USSR in the practice of oncology and in the availability of highly trained oncologists and equipment. Thus, in certain of the Central Asian republics less than 40% of the patients are treated surgically and reliance is placed primarily on chemotherapy, whereas in the RSFSR, the Baltic republics, and Azerbaydzhan surgery is employed in managing 50-60% of the cases. Further improvements and efficiency can be expected from the increased Soviet manufacture of therapeutic and diagnostic instruments, construction of new clinics, enhancement of basic and clinical research efforts, and encouragement of postgraduate training in oncology.
[277-12172]

UDC 613.6-051:658.381.015.2

WORK STRUCTURE AND TIME INPUT FOR A PHYSICIAN SPECIALIZING IN INDUSTRIAL HYGIENE AND HIS ASSISTANTS AT A RAYON SANITARY AND EPIDEMIOLOGICAL STATION

Moscow GIGIYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 2, 1980 pp 29-30 manuscript received 28 Mar 79

BIDA, M. P., and SLIVKOV, A. A., Dolinskiy Rayon Sanitary and Epidemiological Station (Ivano-Frankovsk)

[Abstract] Analysis was made of different types of work done by the physician and his assistants, with determination of work elements that could be performed by other than the pyysician to augment his work input in those areas where his competence is required. A table is enclosed showing the breakdown for work done in various sectors of the economy including laboratory monitoring of chemical and physical factors in industrial premises. Elements analyzed include frequency of inspections by the physician and assistants. Means of improving the efficiency of sanitary and epidemiological station staff are discussed. Figures: 1.
[272-10,657]

UDC 616.127.42-089.193.4

SURGICAL PROCEDURES IN REPEATED OPERATIONS ON THE MITRAL VALVE

Moscow KARDIOLOGIYA in Russian No 2, 1980 pp 54-59 manuscript received 28 May 1978

TSUKERMAN, G. I., SEMENOVSKIY, M. L., DUBROVSKIY, V. S., NAZARENKO, V. P., ZUBKOVA, G. A., and YULDASHEV, D. Ya., The Department of Acquired Heart Defects of the A. N. Bakulev Institute of Cardiovascular Surgery, Academy of Medical Sciences of the USSR, Moscow

[Abstract] The study evaluates results of 3950 closed mitral commissurotomies, of which 340 were being repeated. Surgical corrections of the heart included various degrees of restenosis and calcinosis of the mitral valve, and of those operated on by a closed heart surgery procedure. The majority of operations followed a right-side approach method. Results including mortality are discussed, as well as the use of open heart surgery to correct mitral valve insufficiencies, and external circulation with closed operation procedures. Conclusions point to the need for thorough data on the degree of calcinosis ond regurgitation of the valve and the presence or absence of thrombosis of the left ventricle before choosing the appropriate closed or open procedure and the need for available external circulation systems during repeated valve operations. Figures 2, tables 2, references 26: 11 Russian, 15 English.

[283-12131]

UDC 616.12-089.15:312

A MEDICAL SURVEY METHOD FOR IDENTIFYING CARDIOSURGICAL PATIENTS

Moscow KARDIOLOGIYA in Russian No 2, 1980 pp 59-63 manuscript received 22 May 1978

MESHALKIN, Ye. N., SIDOROV, P. M., SHURGAYA, A. M., ALKS, D. O., SOLOV'YEV, V. M., BAKHTINA, G. G., KULESHOVA, R. G., MEZENTSEVA, N. M., and BUSHMANOVA, G. M., The Novosibirsk Scientific Research Institute of Blood Circulation Pathology of the Ministry of Health Care of the RSFSR

[Abstract] Electrocardiography, X-rays, biochemical tests and a physical exam were performed on patients complaining of heart ailments. The results were recorded on a computer card and the patients were classified on the basis of needs for further examination and treatment of heart problems. The first group contained those where surgery was indicated, the second, those with congenital and acquired ailments requiring further study, and the third, those needing out-patient reexaminations. Tables 2, references 10 in Russian.

[283-12131]

UDC 615.472:615.838.97:553.76

A NEW DEVICE FOR RADON INHALATIONS AND AERO-RADON BATHS AT THE PYATIGORSK HEALTH RESORT

Moscow VOPROSY KURORTOLOGII, FIZIOTERAPII I LECHEBNOY FIZICHESKOY KUL'TURY in Russian No 1, 1980 pp 66-69

GUSAROV, I. I., PEN, E. Z., ANDREYEV, S. V., YESTAF'YEV, V. P., ABRAMOV, V. I., RAYKHMAN, Ye. S. (DECEASED), KHOTYANOV, I. A., SELIKHOVA, R. A., and NIKITINA, T. G., Radiobiologic Laboratory, Central Institute of Health Resort Sciences and Physiotherapy, the Balneotechnical Section of the "Geo minvod" Office, and the Pyatigorsk Territorial Soviet for for Administration of VTSSPS [expansion unknown] Labor Unions' Health Resorts

[Abstract] In order to improve the quality and safety of radon therapy at the Pyatigorsk Health Resort a new device has been put into service for delivering radon for inhalation or total body exposure in an air filled tank. The schema for the device includes a means for extracting radon from the natural waters with 86-88% efficiency, as well as for the elimination of radon daughter products. During inhalation therapy (ten 15 min procedures) the following exposure levels are achieved: kidneys 0.19 rem, upper respiratory tract 0.12 rem, and 0.08 rem for the skin and the lungs (significantly below the natural exposure level of 1.5 rem per year). Exposure in the air chamber in the nude under similar conditions provides dosages of ca. 0.4 rem per session, which is 4-4 1/2 times greater than the exposure obtained in water baths. Figures 4; References: 5 Russian. [253-12172]

UDC 616.2-036.11-053.2-036.886-07:616.127-091-07

PATHOMORPHOLOGICAL CHANGES IN THE MYOCARDIUM OF CHILDREN WHO HAVE DIED SUDDENLY OF ACUTE RESPIRATORY AILMENTS

Moscow ARKHIV PATOLOGII in Russian No 1, 1980 pp 56-60 manuscript received 3 Apr 1980

DIKSHTEYN, Ye. A., and SERGEYEVA, L. A., The Department of Anatomical Pathology of the M. Gorky Donetsk Medical Institute, and the Oblast Bureau of Legal Medical Expertise

[Abstract] The hearts of 32 children, aged from several days to 5 years, who had died from acute respiratory ailments, were sectioned so that each specimen contained all parts of the heart wall; longitudinal sections were taken from the left ventricle and the inter-chamber segment. The specimens were stained and studied by various methods. Pathomorphological changes were most pronounced in the left ventricle and its connecting

muscles. The changes were related to hemodynamics and distrophic disorders of metabolism. Protein metabolism of the sub-endocrine layer suffered vacuole distrophy. Respiratory ailments combined with pneumonia aggravated to hypoxia to bring gross myocardial changes in the cytoplasm and particularly in microfibrillae. One figure, references 11: 8 Russian, 1 Polish, 2 English.
[281-12131]

UDC 615.471:616-078.73-71

EXPERIENCE WITH AUTOMATIC GRUPAMATIK-MZH-50 MACHINE FOR SEROLOGICAL TESTS

Moscow PROBLEMY GEMATOLOGII I PERELIVANIYA KROVI in Russian No 1, 1980 pp 53-56 manuscript received 4 Nov 78

AVDEYEVA, R. A.; DIVOVICH, G. M.; YEGOROV, V. M.; and ZOTIKOV, Prof Ye. A, Department of Isoimmunology (headed by Prof Ye. A. Zotikov), Central Institute of Hematology and Blood Transfusion (director: O. K. Gavrilov, corresponding member of the USSR Academy of Medical Sciences), USSR Ministry of Health, Moscow

[Abstract] There are two firms that manufacture existing instruments for serological blood tests: Technicon in the United States and Labotron in France, the latter being used extensively in many countries. The "Grupamatik" [Groupamatique] series is manufactured by Labotron in two current models: Groupamatique-MJ 50 and MJ-360, the digits referring to their output per hour of operation. The construction of Groupamatique-50 is described in detail. It was tested for routine blood tests, which can be made by direct and cross methods on this machine. Special test tubes, also manufactured by Labotron, have to be used. For successful use of the Groupamatique, preservative media must be used with utmost stabilizing activity in minimum quantities, as well as reagents with high antibody titer. Figures 1; references 2: 1 Russian, 1 Western.
[220-10,657]

UDC 613.2+614.71]:614.73(470.311)"1973-1976"

RADIOACTIVITY OF THE AIR AND SOME FOODS IN MOSCOW IN 1973-1976

Moscow GIGIYENA I SANITARIYA in Russian No 10, 1979, pp 28-31

[Article by A. S. Zykova, Ye. L. Telushkina, G. P. Yefremova, G. A. Kuznetsova, and V. V. Kiselev, submitted 2 Jan 1978]

[Text] This article presents the data on the concentration of artificial radioactive aerosols in the surface atmospheric layer of Moscow, as well as on the dynamics of their fallout on the surface of the earth in 1973-1976. Moreover, information is given on the content of ^{90}Sr and ^{137}Cs in some foodstuffs (milk, potatoes, and vegetables) sampled quarterly in three rayons of Moskovskaya Oblast.

The density of the radioactive fallout for each month of the above period in Moscow in the suburban zone indicates that the radioactive fallout in the course of the year is not uniform. As a rule, the maximum fallout density occurs in the spring-summer and autumn periods.

Table 1 shows the data characterizing the isotopic composition of radioactive fallout, as well as the fallout levels of the sum of beta-active aerosols and main radionuclides in the course of 1973-1976.

In 1973, the total fallout of radioactive substances decreased to one half in comparison with 1972, being only 21.8 mCi/km^2, i.e., was minimal during the 17-year period of observation (A. S. Zykova et al).

Analysis of the isotopic composition of the radioactive fallout showed that the total beta-activity of the fallout resulted from the presence of the main fission products of U:

In connection with a thermonuclear explosion conducted in the People's Republic of China on 27 September 1976, the density of radioactive fallout increased sharply in October of that year both in Moscow and, particularly, in the suburban zone, amounting to 17.4 and 28.2 mCi/km^2, respectively, i.e., approximately 60 and 80% of the annual amount. A substantial contribution to the total beta-activity of the fallout was made by short-lived fission products: ^{95}Zr → ^{95}Nb; ^{103}Ru, ^{141}Ce.

Table 1

Fallout of Radioactive Aerosols in 1973-1976 (in mCi/km2)

(1) Год	(2) Пункт наблюдения	Общая β-активность (5)	95Zr+95Nb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$^{137}Cs/^{90}Sr$
1973	Москва (3)	21,8	0,2	1,45	2,3	—	—	6,3	0,51	0,3	1,7/1,4
	Пригородная зона (4)	15,8	0,3	1,3	2,3	—	—	5,4	0,49	0,34	
1974	Москва (3)	40,0	6,0	1,6	6,1	0,3	8,2	6,5	0,95	0,68	1,4/1,3
	Пригородная зона (4)	32,0	5,0	1,0	5,3	0,2	7,2	8,3	0,91	0,73	
1975	Москва (3)	25,1	2,1	0,35	3,0	—	3,5	12,6	0,61	0,4	1,5/1,3
	Пригородная зона (4)	21,4	2,0	0,4	2,9	—	3,8	12,6	0,42	0,23	
1976	Москва (3)	27,4	3,9	2,0	0,8	1,3	1,4	13,1	0,26	0,2	1,3/1,4
	Пригородная зона (4)	25,1	8,1	3,2	1,3	3,3	3,0	14,1	0,17	0,12	

Key: 1. Year
2. Observation point
3. Moscow
4. Suburban zone
5. Total beta-activity

Simultaneously with the monitoring of the radioactive fallout in Moscow and the suburban zone, observations were continued on the content of radioactive aerosols in the surface atmospheric layer whose samples were collected on filters of Petryanov's tissue with the aid of special aspiration units. Table 2 shows average annual concentrations of aerosols in the course of 1973-1976.

Table 2

Content of Radioactive Aerosols in the Atmospheric Air in 1973-1976 (in 10^{-17} Ci/l)

(1) Год	(2) Пункт наблюдения	Общая β-активность (5)	95Zr+95Nb	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$^{137}Cs/^{90}Sr$	[illegible]
1973	Москва (3)	4,1	0,16	0,85	1,0	—	0,4	0,18	0,1	1,8/1,5	3,9
	Пригородная зона (4)	3,7	0,15	0,72	0,85	—	0,3	0,09	0,07		3,4
1974	Москва (3)	17,1	3,6	1,1	2,5	0,7	4,0	0,43	0,28	1,5/1,3	4,7
	Пригородная зона (4)	15,9	2,8	1,0	2,9	0,6	2,7	0,25	0,19		4,3
1975	Москва (3)	11,1	2,2	0,7	1,5	—	2,8	0,26	0,15	1,7	8,5
1976	»	4,7	1,82	1,82	0,84	2,37	0,92	0,05	0,03	1,7	7,46

Key: 1. Year
2. Observation point
3. Moscow
4. Suburban zone
5. Total beta-activity

Table 3

^{90}Sr and ^{137}Cs Content of Foodstuffs in 1973-1976 ([illegible])

Вид продукта (1)	^{90}Sr				^{137}Cs				$\frac{^{137}Cs}{^{90}Sr}$			
	1973	1974	1975	1976	1973	1974	1975	1976	1973	1974	1975	1976
Молоко (2)	3,5±0,5 (12)	4,7±1,4 (12)	1,9±0,2 (12)	2,0±0,3 (11)	12,1±2,4 (12)	9,1±2,5 (12)	5,1±0,4 (12)	3,6±0,6 (12)	3,5	1,9	2,7	1,8
Картофель (3)	3,2±1,1 (5)	7,2±2,2 (3)	2,2±0,3 (5)	4,0±0,2 (4)	12,4±4,1 (5)	15,2±3,4 (3)	3,2±0,85 (5)	2,3±0,3 (4)	3,9	2,1	1,45	0,6
Капуста (4)	9,8±2,5 [illegible]	6,0±2,4 (3)	3,3±0,6 (5)	6,65±2,3 (4)	6,5±1,6 (6)	14,4±6 (2)	2,3±0,25 (5)	2,3±0,3 (4)	0,7	2,4	0,7	0,3
Морковь (5)	—	22 (2)	10,4±2,2 (4)	11,1±0,9 (4)	—	42,3 (2)	5,9±3,3 (3)	3,5±1,3 (4)	—	1,9	0,7	0,3
Свекла (6)	—	6,5 (2)	12,1±1,1 (6)	9,5±1,0 (4)	—	12,1 (2)	4,5±0,9 (5)	1,7±0,3 (4)	—	1,9	0,4	0,2

Note. Concentrations of ^{90}Sr and ^{137}Cs in milk are shown in pCi/l, and in other products in pCi/kg; in parentheses -- number of samples.

Key:
1. Type of food
2. Milk
3. Potatoes
4. Cabbage
5. Carrot
6. Beets

Describing the radioactivity level of the atmospheric air in Moscow resulting from the content of artificial radioactive isotopes, it should be mentioned that in 1973 their average total amount in the atmospheric air of Moscow decreased to two-ninths of the 1972 level, being $4.1 \cdot 10^{-17}$ Ci/l. However, in 1974, the radioactivity level of the atmospheric air increased again by a factor of 4 in comparison with 1973, which corresponded to the increase of the radioactive fallout during that period.

In order to continue the monitoring of the content of ^{90}Sr and ^{137}Cs in foodstuffs contaminated due to the entry of radionuclides from the soil and their fallout from the atmosphere, sampling of milk, potato, and vegetables was done in three rayons of the Moskovskaya Oblast. The obtained results are shown in Table 3.

Four years of observations (1973-1976) of the radioactivity level of the atmospheric air and certain foodstuffs in Moscow revealed the following.

In 1973, the density of the radioactive fallout, as well as the content of radioactive aerosols in the surface atmospheric layer decreased considerably in comparison with the preceding period and reached the minimum level for the entire 17-year period of observations. However, in 1974, the fallout of radionuclides and their concentration in the air increased again. In the following years (1975 and 1976), there was a marked tendency toward the lowering of the radioactivity level of the atmospheric level in Moscow.

Along with the increase in the density of the radioactive fallout and the concentration of radioactive aerosols in the air in 1974, there was an increase in the content of ^{90}Sr and ^{137}Cs in some foodstuffs (milk, potatoes, cabbage).

In 1975 and 1976, the concentration of ^{137}Cs in all analyzed foodstuffs was decreasing gradually, however, this regularity was not observed with respect to ^{90}Sr.

The content of ^{90}Sr in vegetables in 1975 and 1976 and in potatoes in 1976 was higher than that of ^{137}Cs. The ^{137}Cs: ^{90}Sr ratio in the above-mentioned foodstuffs varied from 0.2 to 0.7.

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1. Zykova, A. S.; Telushkina, Ye. L; Yefremova, G. P., et al. GIGIYENA I SANITARIYA, 1975, No 3, pp 53-55.

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10,233
CSO: 1840

METHODS FOR ASSAYING SOME RADIOACTIVE ISOTOPES AT THE LEVEL OF OR LESS THAN THE MEAN ANNUAL PERMISSIBLE CONCENTRATIONS IN LIQUID WASTE, ENVIRONMENTAL OBJECTS AND BIOLOGICAL SAMPLES

New York PEACEFUL USES OF ATOMIC ENERGY--Proceedings of the Fourth International Conference on the Peaceful Uses of Atomic Energy Jointly Sponsored by the United Nations and the International Atomic Energy Agency, and held in Geneva, 6-16 Sep 71 in Russian Vol 11, 1972 pp 641-662

[Article by Z. V. Yershova, V. K. Markov, N. Ye. Tsvetayeva, L. A. Ivanova, D. A. Fedoseyev, M. N. Yerofeyeva, N. A. Zemlyanukhina, V. P. Kermanov, M. M. Golutvina, N. Ya. Novikova and M. N. Kulichenko, USSR State Committee for the Use of Atomic Energy, Moscow, USSR]

[Text] Abstract

Appearance in the environment of artificial radioisotopes, in particular such as strontium 90, cesium 137 and plutonium 239, has made it necessary to implement routine monitoring of distribution thereof. This presents high requirements, with respect to rapidity and sensitivity of monitoring methods. This paper submits a brief survey of the known methods for quantitative assay of these radioisotopes. The new methods of assaying strontium 90 (according to yttrium 90), cerium 144 and cesium 137 in salt-free and salt-containing aqueous solutions proposed here are rapid and highly sensitive down to 0.1 of maximum permissible concentration. These techniques are based on a new and very effective principle for concentration of radioisotopes, in which liquid extraction is combined with coprecipitation. For this purpose, an organophosphorus compound is used as extractant--monoisooctyl ester of methyl phosphonic acid ($CH_3P\genfrac{}{}{0pt}{}{\nearrow O}{\searrow OH} - OC_8H_{17}\text{-}i$), which forms a solid organic phase in the presence of some cations--mixed organic salts in the form of flocculated deposits that can be readily separated from the aqueous solution. In this manner, the radiosotopes to be assayed can be virtually entirely (98-100%) extracted from large volumes of aqueous solutions (V_a = 1-20 ℓ) in small amounts of solid organic phase (v_0 = 0.5 to 10 g. respectively), and no more than 30 min is required for this. It is also possible to assay these radioisotopes separately in the same sample.

There are two important advantages to the combination of liquid extraction and coprecipitation: in the first place, a rather high coefficient of distribution with $D \approx 10$; in the second place, a solid organic phase is formed that can be readily separated from the aqueous solution. Both this qualities make it possible to concentrate to a very high degree (by over 10^3 times) the radioisotopes with sufficient and selective extraction thereof. A prerequisite was formulated for extraction into the organic phase of $\geqslant 90\%$ of the isotope under study and $\leqslant 9\%$ interfering isotopes. The simplicity and speed of the proposed techniques make it possible to use them for regular monitoring of liquid waste from treatment plants, open bodies of water, underground water, atmospheric precipitations, etc., even under field conditions. The authors discuss the possibility of using these methods in the presence of macroimpurities, and they describe the conditions for analysis to assay ^{90}Sr, ^{144}Ce and ^{137}Cs in sea water, foodstuffs and various biological specimens (urine, bone tissue, lung tissue, teeth).

The assay of ^{90}Sr in biological objects is made satisfactorily even when the levels are below the maximum permissible concentration. The paper describes a method of assaying ^{239}Pu based in liquid extraction of monoisooctyl methylphosphonic acid and a mixture of isoamylphosphoric acids in a phase volume ratio of $v_a/v_o \leqslant 100$. This technique is used for assaying ^{239}Pu content of lung tissue, bone tissue, water in open reservoirs and other environmental objects.

Introduction

At the present time there is a need for regular monitoring of levels of the most hazardous radioisotopes (for example, ^{90}Sr, ^{137}Cs, ^{239}Pu and ^{144}Ce) in environmental objects and biological samples at radioactivity levels that are lower than the mean annual permissible concentrations (MPC) [1]. In most cases direct radiometric monitoring of such low concentrations of radioisotopes is impossible, so that selective preliminary concentration of the radioisotope under study is required.

Many works have been published in recent years proposing various methods of concentration of these radioisotopes [2-7]. Extraction techniques for concentration are widely known, for example, those using TBP [tributyl phosphate] [8, 9] and D2EGFK [should be H_2MEHP for mono-2-ethyl hexyl phosphoric acid] [10-13].

In this work, we propose new techniques for assaying low levels in aqueous solutions of ^{90}Sr (according to ^{90}Y), ^{144}Cs, ^{137}Cs and ^{239}Pu, which are based on concentration of these isotopes by means of extracting them from large volumes of solutions with small amounts of liquid extractants, which form extracts in the form of a readily separated solid phase, as well as by means of extraction of plutonium with a fine film of extractant fixed on the surface of a solid carrier.

Correlation Between Concentration, Extraction and Separation of Radioisotopes During Extraction

In the case of such a high degree of concentration, there is distinctive manifestation of a correlation between thoroughness, selectivity of extraction of radioisotopes and degree of concentration thereof.

Using the equation for balance of matter in extraction, $c_b v_a = c_o v_o + c_r v_a$,* we obtain the equation for evaluation of extent of extraction of a radioisotope into the organic phase, $q = c_o v_o / c_b v_a$:

$$q = \frac{1}{1+1/\delta} \tag{1}$$

In equation (1) δ refers to the following:ratio:

$$\delta = \frac{D}{v_a/v_o} \tag{2}$$

where D is the coefficient of distribution of the extracted radioisotope and v_a/v_o is the ratio between phase volumes.

According to equations (1) and (2), for virtually complete extraction of a radioisotope ($q \to 100\%$), the coefficient of its distribution must be significantly higher than the phase volume ratio:

$$D_I \gg \frac{v_a}{v_o} \tag{3}$$

From equations (1) and (2) we also obtain the condition for extracting as little as possible of any other radioisotopes present in the mixture along with the one to be concentrated:

$$D_{II} \ll \frac{v_a}{v_o} \tag{4}$$

where D_{II} is the coefficient of distribution of each of the interfering radioisotopes. By putting together inequalities (3) and (4), we obtain the condition for quantitative and selective extraction of a radioisotope into the organic phase:

$$D_I \gg \frac{v_a}{v_o} \gg D_{II} \tag{5}$$

or

$$\delta_I \gg 1 \gg \delta_{II} \tag{6}$$

where $\delta_I = \frac{D_I}{v_a/v_o}$; $\delta_{II} = \frac{D_{II}}{v_a/v_o}$.

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*It is assumed that there is no change in volume v_a during the extraction process; subscript b refers to base, or initial value.

The need to meet condition (5) for separation of radioisotopes is evident from the examples obtained from estimated graphic extraction of radioisotopes with distribution coefficients $D' = 10$, $D'' = 10^3$ and $D''' = 10^5$ as functions of phase volume ratio v_a/v_o (Figure 1).

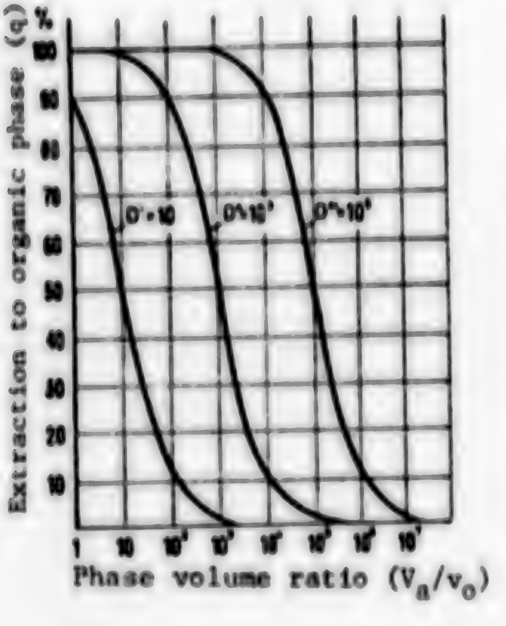


Figure 1.
Extraction of radioisotopes with different distribution coefficients as a function of phase volume ratio

As can be seen in Figure 1, in the case of $v_a/v_o = 1$, all radioisotopes with $D>10$ are extracted virtually completely into the organic phase: 91, 99 and 99.9%, respectively. In this case, condition (5) is not met, and it is impossible to separate the isotopes regardless of value of their separation coefficient (D_1/D_2).

Figure 1 also shows that separation becomes possible as soon as condition (5) is met, i.e., when the value of the phase volume ratio will be between the coefficients of distribution, for example, $D_I = 10^3$; $v_a/v_o = 10^2$; $D_{II} = 10$ or $D_I = 10^5$; $v_a/v_o = 10^2$; $D_{II} = 10$. The higher the separation coefficient, the deeper separation will be.

Thus, condition (5) shows the sequence of values of distribution coefficients and phase volume ratios required to separate isotopes, without defining the quantitative correlation between them.

In order to determine optimum conditions for separation of two radioisotopes, it is expedient to analyze the ratio of shares thereof changed to the organic phase as a function of D_I, D_{II} and v_a/v_o:

$$\frac{q_I}{q_{II}} = \frac{D_I}{D_{II}}\left(\frac{1+\delta_{II}}{1+\delta_I}\right) \qquad (7)$$

It is of the itmost importance here to determine the possibility of separation for quantitative extraction of one of them to the organic phase, and this will occur if $D_I \gg v_a/v_o$, and then equation (7) will acquire the following appearance:

$$\frac{q_I}{q_{II}} = \left[1 + \frac{1}{\delta_I}\left(\frac{D_I}{D_{II}}\right)\right]_{\delta \gg 1} \qquad (8)$$

or

$$\frac{q_I}{q_{II}} = \left[1 + \frac{1}{\delta_{II}}\right] \qquad (9)$$

Equation (8) is graphically illustrated in Figure 2, which shows that the possibility of separation is not unequivocally determined by the coefficient of separation, but that it is also related to the value of the coefficient of distribution and phase volume ratio.

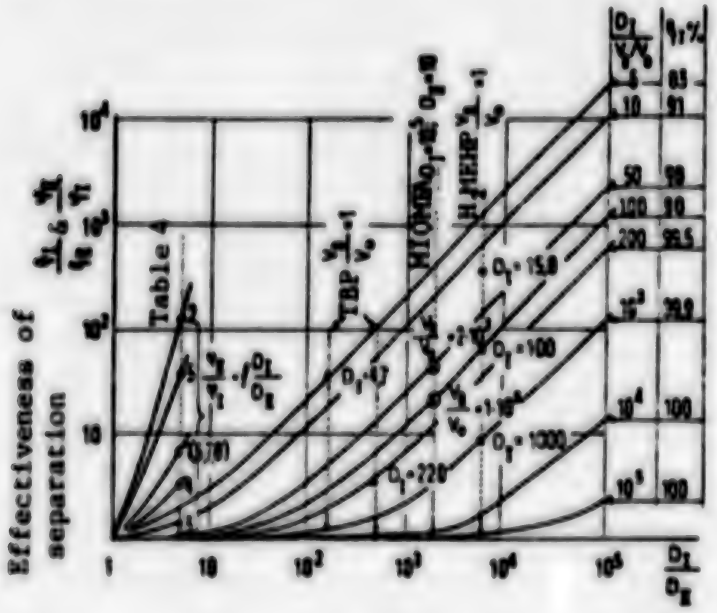


Figure 2. Effectiveness of separation of two components as a function of coefficient of separation D_I/D_{II} with different values for $D_I/(v_a/v_o)$

Key: V_B) volume of aqueous phase

New Principle of Concentration of Radioisotopes

The proposed methods are based on the use of a new organophosphorus compound, monoisooctyl methylphosphonic acid--MIOMPA ($CH_3P\overset{\nearrow O}{\underset{\searrow OH}{}}OC_8H_{17}$-1), which was synthesized by Prof K. A. Petrov. The physical characteristics of MIOMPA are: $n_D^{20} = 1.4405$, $M = 208$, $\rho = 0.9462$, $t_{boil.} = 130°C$ at 10^{-6} mm Hg.

MIOMPA resembles the well-known extractant H_2MEHP in its extractive properties; the latter was proposed originally by Peppard et al. for separation of rare earth elements [10]. MIOMPA, like H_2MEHP, is an organic acid, which extracts well elements in the rare earth group, as well yttrium, forming an organic salt with them, a hard amorphous substances. MIOMPA is virtually ineffective in extracting elements of the first and second groups (see Table 1).

Table 1. Coefficients of distribution (D) and extraction (q) of some radioisotopes when extracted in trivalent iron MIOMPate from nitrate solutions of 0.4 N with a phase volume ratio of $v_a/v_o = 2 \cdot 10^3$

Radioisotope	q,%	D
^{90}Sr	$\leq 0{,}01$	$\ll 1$
^{137}Cs	$\leq 0{,}01$	$\ll 1$
^{41}Ca	$\leq 0{,}01$	$\ll 1$
^{65}Zn	$\leq 0{,}01$	$\ll 1$
^{140}Ba	$\leq 0{,}01$	$\ll 1$
^{14}C	$\sim 0{,}01$	$\ll 1$
^{60}Co	0,3	7
^{140}La	2	34
$^{144}Ce\,III$	3	70
^{147}Pm	15	302
^{131}J	23	602
$^{152-154}Eu$	30	860
$^{59}Fe\,III$	30	860
$^{95}(Zr\text{-}Nb)$	73	$5{,}5 \cdot 10^3$
^{46}Sc	89	$1{,}7 \cdot 10^4$
^{90}Y	≥ 98	$\geq 1 \cdot 10^5$
$^{144}Ce\,IV$	≥ 98	$> 1 \cdot 10^5$
$^{239}Pu\,III$	> 99	$\geq 1 \cdot 10^5$
$^{239}Pu\,IV$	> 99	$> 1 \cdot 10^5$
$^{239}Pu\,VI$	90	$1 \cdot 10^4$

MIOMPA forms a solid salt, trivalent irone MIOPate, with ions of trivalent iron over a wide range of acidity, from pH 6-7 to 4 N HNO_3 (HCl). It is known that there are also other organic acids that form solid organic salts with trivalent iron ions [5, 12, 14]. We obtained organic deposits from interaction of trivalent iron ions and H_2MEHP and isoamylpyrophosphoric acid. However, the formation of a deposit with H_2MEHP is possible only within a narrow range of acidity (pH = 2.0–2.5).

Trivalent iron MIOMPate has some very valuable properties, which open up vast possibilities for concentrating radioisotopes from very dilute aqueous solutions. Thus, there is an increase in extraction of radioisotopes into the organic phase with formation of the former, as a result of which there is a drastic increase in distribution coefficients (Table 2).

Table 2. Comparative extraction of some radioisotopes from aqueous solutions through liquid extraction with MIOMPA and extraction into the solid organic phase, MIOMPate of trivalent iron for $v_a/v_o = 10^3$

Radioisotope	(N)	Organic phase extraction, (%)			Distribution coefficient			Sorption on MIOMPate %
		Liquid extraction with MIOMPA, q_{liq}	Extraction in iron MIOMPate q_{eff}	Due to formation of solid deposit $q_{eff}-q_{liq}$	Liquid extraction D_{liq}	Extraction in iron MIOMPate D_{eff}	$\frac{D_{eff}}{D_{liq}}$	
^{91}Y	0,2	78	99	21	$1{,}6 \cdot 10^3$	$1 \cdot 10^5$	62	3
	0,3	63	99	36	$8{,}5 \cdot 10^2$	$1 \cdot 10^5$	118	2
	0,4	55	99	44	$6{,}0 \cdot 10^2$	$1 \cdot 10^5$	166	1
	0,6	22	98	76	$1{,}4 \cdot 10^2$	$5{,}0 \cdot 10^4$	360	0
	0,8	2	86	84	10	$8{,}0 \cdot 10^3$	800	0
	1,0	1	70	70	3	$2{,}0 \cdot 10^3$	500	0
Pu IV	0,2	89	100	11	$4 \cdot 10^3$	10^5	25	80
Pu III	0,2	93	100	7	$1 \cdot 10^4$	10^5	10	0
Pu IV	0,4	93	99	6	$1 \cdot 10^4$	$1 \cdot 10^5$	10	42
Pu III	0,4	94	99	5	$1 \cdot 10^4$	$1 \cdot 10^5$	10	5
Pu IV	1,0	94	99	5	$1 \cdot 10^4$	$1 \cdot 10^5$	10	70
Pu III	1,0	85	99	14	$3 \cdot 10^3$	$1 \cdot 10^5$	33	15
Pu IV	2,0	95	99	4	$1 \cdot 10^4$	$1 \cdot 10^5$	8	65
Pu III	2,0	75	99	24	$2 \cdot 10^3$	$1 \cdot 10^5$	50	40

The finely dispersed deposite of iron MIOMPate in the presence of a small amount of toluene acquires a large-grain structure and marked hydrophobic properties, for which reason phase separation occurs simultaneously with formation of the deposit, and no time is needed for settling as is the case with precipitating operations. For this reason, after mixing the solution for 20 min, the formed deposit can be immediately separated from the aqueous phase by filtration through gauze or other mesh filter. The separated deposit consists of a plastic [substance] from which it is easy to make a preparation of any configuration for measurement of both beta and gamma radiation.

High distribution coefficients combined with the simplicity of separation of the organic phase from the aqueous phase, and lack of need to allow the solution to settle are the elements that provide for a rapid method with quite high and selective concentration of radioisotopes. All this distinguishes the new concentration principle favorably from the methods for precipitation and liquid-liquid extraction in current use.

Extraction of Some Radioisotopes With Iron MIOMPate and Comparison to Liquid Extraction

We used trivalent iron MIOMPate to concentrate some radioisotopes for analytic purposes to assay small amounts (<MPC) of ^{90}Sr (according to ^{90}Y), ^{144}Ce and ^{239}Pu in aqueous solutions.

Extraction of the above radioisotopes with MIOMPate has definite advantages over liquid extraction, from the standpoint of feasibility of concentration of radioisotopes. This is related to the fact that, in the case of liquid extraction, separation of small volumes of the organic phase from large volumes of the aqueous phase is difficult and the phases are usually of comparable volume ($v_a/v_o = 0.1 \div 10$), while concentration with the use of iron MIOMPate is most often performed with a volume ratio of $v_a/v_o = 2 \cdot 10^3$ (see Figure 3).

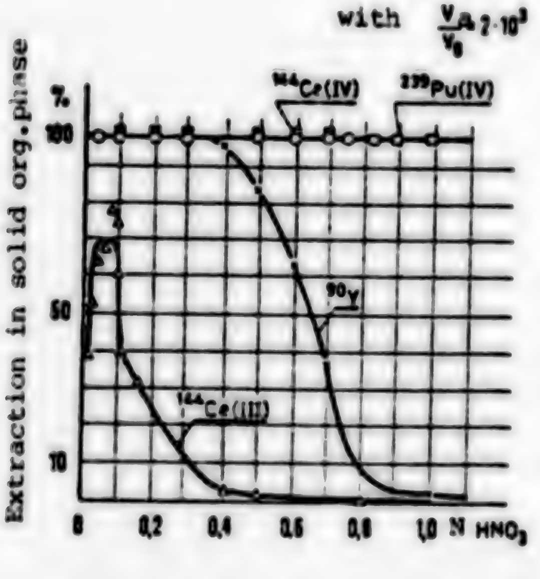


Figure 3.
Extraction of isotopes in solid organic phase as a function of concentration of nitric acid

Moreover, selectivity is a quite important feature in extraction of radioisotopes. Figure 4 illustrates the estimated curves of extraction of radioisotopes in theorganic phase as a function of coefficient of distribution (D) for $v_a/v_o = 1$, $2 \cdot 10^3$ and 10^4. The dots refer to experimental results of extraction of some radioisotopes. A comparison of the three curves shows that, with increase in phase volume ratio, there is a broader possibility of selective extraction. For a more specific evaluation of this possibility, we compared separation of yttrium and cerium using trivalent iron MIOMPate to the best results obtained with liquid extraction [10, 15] (see Table 3 and Figure 2). We see that with high phase volume ratios separation of these radioisotopes with MIOMPate compares well with separation using liquid extraction.

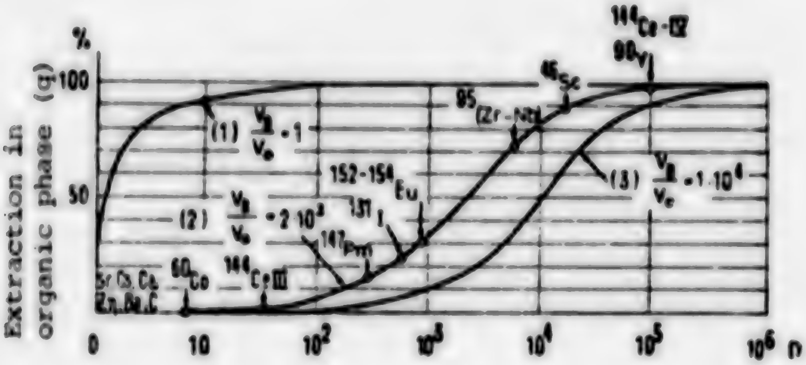


Figure 4. Extraction of isotopes into organic phase as a function of distribution coefficient, with different phase volume ratios

Key: V_B) aqueous phase volume

It should also be noted that the magnitude of the separation coefficient of yttrium and cerium (D_Y/D_{Ce}) does not determine the possibility of separating these radioisotopes, not only with extraction into the solid organic phase, but also with liquid extraction. This is particularly noticeable on the example of separation of yttrium and cerium using TBP for extraction [15], when the best separation corresponds to a lower separation coefficient (see Table 3 and Figure 2). An analogous inconsistency between magnitude of separation coefficient D_I/D_{II} and possibility of separation of two components is observed with liquid extraction in a stream [16]. In this case, separation of two components should be determined both by the relative content thereof after extraction in the raffinate, i.e., aqueous phase (ϕ_{II}/ϕ_I). According to the estimates, shown in Table 4, with an unchanged separation coefficient the actual separation of components can change over a wide range, depending on the magnitude of the ratio ($D_I(v_o/v_a)$). The submitted estimated data and experimental results indicate that separation depends not only on differences in distribution coefficients, but magnitude thereof, as well as phase volume ratio. Separation improves with equal phase volumes, as the coefficients of distribution or their equivalents ($\delta = D/(v_o/v_a)$) decrease. with differing volumes. All this is valid when condition (5) is met. Otherwise, separation is impossible, regardless of degree of difference in distribution coefficients or magnitude thereof.

Extraction With Trivalent Iron MIOMPate--Combination of Liquid Extraction and Coprecipitation

As a result of combining two extraction processes, liquid extraction and coprecipitation, there is an increase in effectiveness of extraction of radioisotopes using iron MIOMPate, as compared to liquid extraction with MIOMPA. This ensues from the experimental data (see Table 2 and Figure 5), showing extraction of radioactive yttrium to the organic phase as a function of acidity of solution in the case of liquid extraction with MIOMPA and with MIOMPate. We see that a significant part of the yttrium is extracted from the aqueous solution during formation of the solid deposit, i.e., as a result of coprecipitation. This is associated with negligible sorption of this isotope. Evidently, coprecipitation occurs as a result of formation of polymer aggregates, in which the radioisotope, in this instance radioyttrium, is contained as a structural microcomponent.

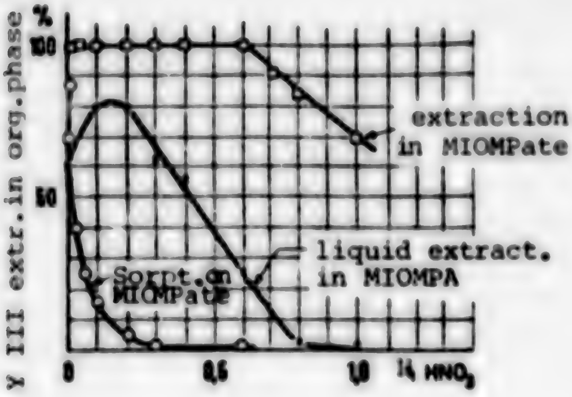


Figure 5.
Extraction of Y III as a function of concentration of nitric acid

In many cases, these two processes supplement one another when they occur simultaneously, providing for quantitative extraction of radioisotopes into the organic phase. This is observed with Pu IV over a wide range of acidity (Figure 6), Pu III with acidity of 0.1-0.2 N HNO_3 (Figure 7), Y III with 0.1÷0.3 N HNO_3 (Figure 5), as well as Ce IV.

However, in some cases, when running these processes simultaneously, there may be substantially less extraction of a radioisotope than [illegible] running liquid extraction followed by coprecipitation (Figure 7). Differences in radioisotope extraction in the case of separate and simultaneous use of reagents are also observed for Pu III and Pu IV, and for Ce III with low acidity (<0.1 N HNO_3)(Figures 6, 7 and Table 5). These results indicate that the radioisotope extraction process is depressed, under certain conditons, by the process of formation of iron MIOMPate.

Table 3. Comparative separation of yttrium and cerium III by extraction in trivalent iron MIOMPate and liquid extraction using H$_2$MEHP and TPB

Method of separation of yttrium and cerium III	D_Y	D_{Ce}	D_Y/D_{Ce}	v_a/v_o	φ_Y,%	φ_Y/φ_{Ce}	Extraction conditions
Extraction in trivalent iron MIOMPate (authors' data)	10^5 10^5 10^5 10^5	70 70 70 70	1430 1430 1430 1430	1 10 10^3 10^4	100 100 99 91	1 1,18 15,1 131	0,4 N HNO$_3$
Liquid extraction with H$_2$MEHP [10]	15,8 100 1000	0,0025 0,017 0,17	$6\cdot10^3$ $6\cdot10^3$ $6\cdot10^3$	1	94 99 100	380 60 6	0,5 N HCl 0,3 N HCl 0,1 N HCl } 0.75 M H$_2$MEHP in toluene
Liquid extraction with TBP [15]	220 4,7	0,62 0,029	325 162	1 1	99,5 82,5	3,4 29	15 N HCl, 100% TBP 12,5 N HCl, 40% TBP in kerosene

Table 4. Estimate of effectiveness of separation by liquid extraction of two components (φ_{II}/φ_I) with distribution coefficients D_I and D_{II} as a function of $D_I(v_o/v_a)$ with unchanging separation coefficient D_I/D_{II}

Component distribution coefficient		$\frac{D_I}{D_{II}}$	$\frac{v_o}{v_a}$	$D_I\frac{v_o}{v_a}$	Postextract. component content in raffinate,%*		$\frac{\varphi_{II}}{\varphi_I}$	Comments
D_I	D_{II}				φ_I	φ_{II}		
0,71	0,14	5,05	2,06	1,46	6,7	46,9	6,95	Example taken from [16], p 90
7,1	1,4	5,05	2,06	14,6	0,03	3,6	120	Proportionate increase in distribution coefficients
0,071	0,014	5,05	2,06	0,146	88,9	92,0	1,1	Proportionate decrease in coefficients D_I and D_{II}
0,71 0,71	0,14 0,14	5,05 5,05	3,0 5,0	0,237 0,142	10,3 1,05	34,4 20,0	3,3 19	Increased v_o/v_a ratio with same values of D_I and D_{II} as in the example from [16]
1,46 14,6 0,485	0,29 2,9 0,0965	5,05 5,05 5,05	1,0 0,1 3,0	1,46 1,46 1,46	6,7 6,7 6,7	46,9 46,9 46,9	7 7 7	Proportionate changes in distribution coefficients, while volume ratio changes so that $D_I \frac{v_o}{v_a}$ = constant

*Initial levels of components I and II in aqueous phase are taken as 100% each.

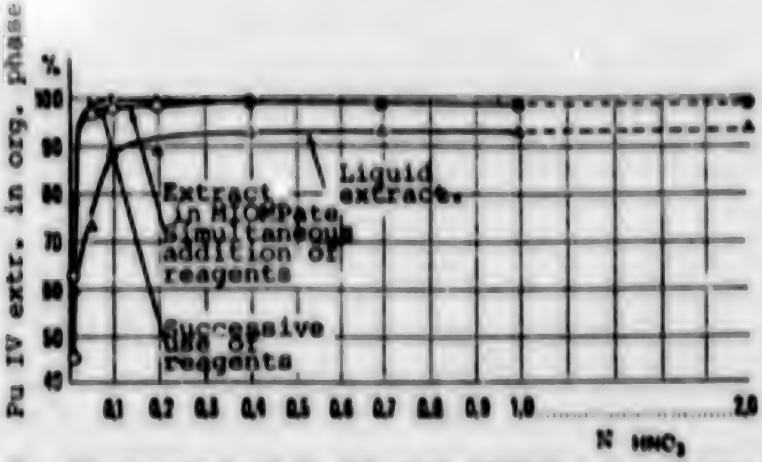


Figure 6. Extraction of Pu IV with MIOMPA as a function of concentration of nitric acid

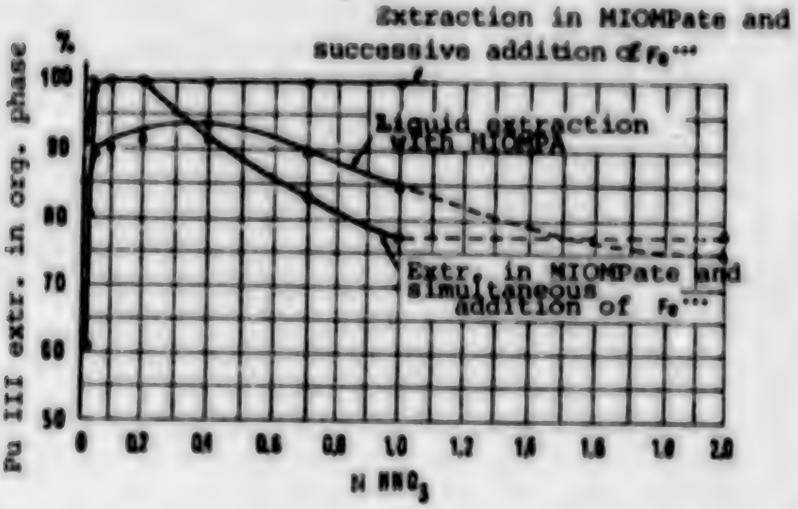
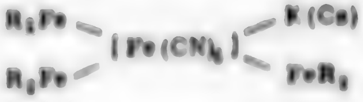


Figure 7. Extraction of Pu III with MIOMPA as a function of concentration of nitric acid

There is a combination of liquid extraction with MIOMPA and coprecipitation with trivalent iron MIOMPate in extraction of all radioisotopes, with the exception of radiocesium. In the latter case, extraction occurs as a result of complex coprecipitation with mixed ferrocyanide MIOMPate of iron and potassium (Figure 8). In all likelihood, this process is a combination of two precipitating processes. Ions of trivalent iron interact with potassium ferrocyanide, on the one hand, and with MIOMPA/HR/, on the other. As a result, an insoluble multinuclear complex is formed, perhaps:



$$\begin{matrix}R_3Fe & & K(Cs)\\ & [Fe(CN)_6] & \\ R_3Fe & & FeR_3\end{matrix}$$

which coprecipitates radiocesium.

Practical Use of the Proposed Concentration Method for Assaying Radioisotopes

Methods for assaying ^{90}Sr (according to ^{90}Y), ^{137}Cs, ^{144}Ce and ^{239}Pu in various environmental objects and biological samples were developed on the basis of the new principle of concentration. The sensitivity of these methods is attributable to the high degree of radioisotope concentration, which reaches $10^3 \div 10^6$ (see Table 6). The coefficient of variation is in the range of 10-20% in the different methods. Selectivity can be increased by removing impurities from the samples by means of preextraction. This is used in isolating ^{90}Y, ^{144}Ce and ^{137}Cs from a complex isotope mixture. In the case of ^{90}(Sr-Y), the sample is allowed to stand for a certain time prior to the main extraction.

"Stepped" extraction is also used to increase sensitivity, for example, to assay ^{90}Sr in the presence of large amounts of ^{106}Ru. This procedure is based on breakdown of the primary solid extract with alkali, with isolation of radioisotopes on iron hydroxide and repeated extraction of the analyzed isotopes from a nitric solution, which is obtained after dissolution of hydroxide.

The proposed methods make it possible to use the same sample for assays of several radioisotopes. Figure 9 and Table 7 illustrate one of the possible schemes for such an assay.

Table 5. Comparative results of extracting some radioisotopes with concurrent introduction of organic phase and ions of trivalent iron, and with separate addition and mixing thereof with the solution

Isotope	Acidity of solution	Extraction in trivalent iron HDEHPate, %				
		successive addition of reagents q_1	simultaneous addition q_2	by liquid extraction		Due to coprecipitation $q_c = q_1 - q_{liq_1}$
	N HNO$_3$			successive addition q_{liq_1}	simultan. addition q_{liq_2}	
Pu IV	0.25	78	61	61	28	17
Pu III	0.25	81	62	81	52	30
Pu III	0.7	90	66	90	75	0
Pu III	1.0	98	70	85	60	13
Ce III	0.05÷0.075	90	10	-	-	<20

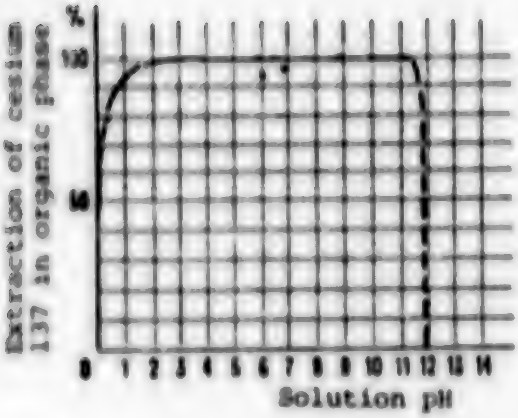


Figure 8.
Extraction of Cs into organic phase--ferrocyanide MIOMPate, as a function of solution pH

Table 6. Characteristics of extraction of radioisotopes from aqueous solutions using MIOMPA

Radioisotope	Acidity range N HNO_3	Extraction to organic phase		Degree of concentration, v_a/v_o	Time of concentr. min	Sensitivity of method, Ci/ℓ
		solid (%)	liquid (%)			
^{90}Y	0,01 ÷ 0,4	98 ± 1	60 ÷ 80	$2 \cdot 10^3$	20	$5{,}0 \cdot 10^{-12}$
^{144}Ce	0,01 ÷ 1,0	98 ± 1	80	$2 \cdot 10^3$	30	$1{,}0 \cdot 10^{-10}$
^{137}Cs	pH 2 ÷ 10	95 ± 5	0,1	$5 \cdot 10^2 ÷ 10^3$	10 ÷ 15	$1{,}0 \cdot 10^{-10}$
^{239}Pu	0,05 ÷ 2,0	95 ÷ 100	80 ÷ 95	$2 \cdot 10^3$	30	$1{,}0 \cdot 10^{-11}$

All of the methods were tested, and they have found application for analysis of natural and waste waters, atmospheric precipitations, soil, vegetation, foodstuffs, bone tissue and biological substrates.

Preparation of all types of samples for analysis amounts to obtaining nitrate solutions (0.01-0.4 N) in volumes of 0.1 to 10 ℓ, from which the isotopes in question are extracted using MIOMPA. For this purpose, ions of trivalent iron (20-100 mg/ℓ) are added to the solution, as well as the appropriate additives, depending on the nature of the radioisotope in question (see Figure 9 and Table 7). The order of procedures is illustrated in Figure 10. The salt composition of the samples does not have an appreciable effect on extraction, if it is represented by groups I and II cations and strong acid anions.

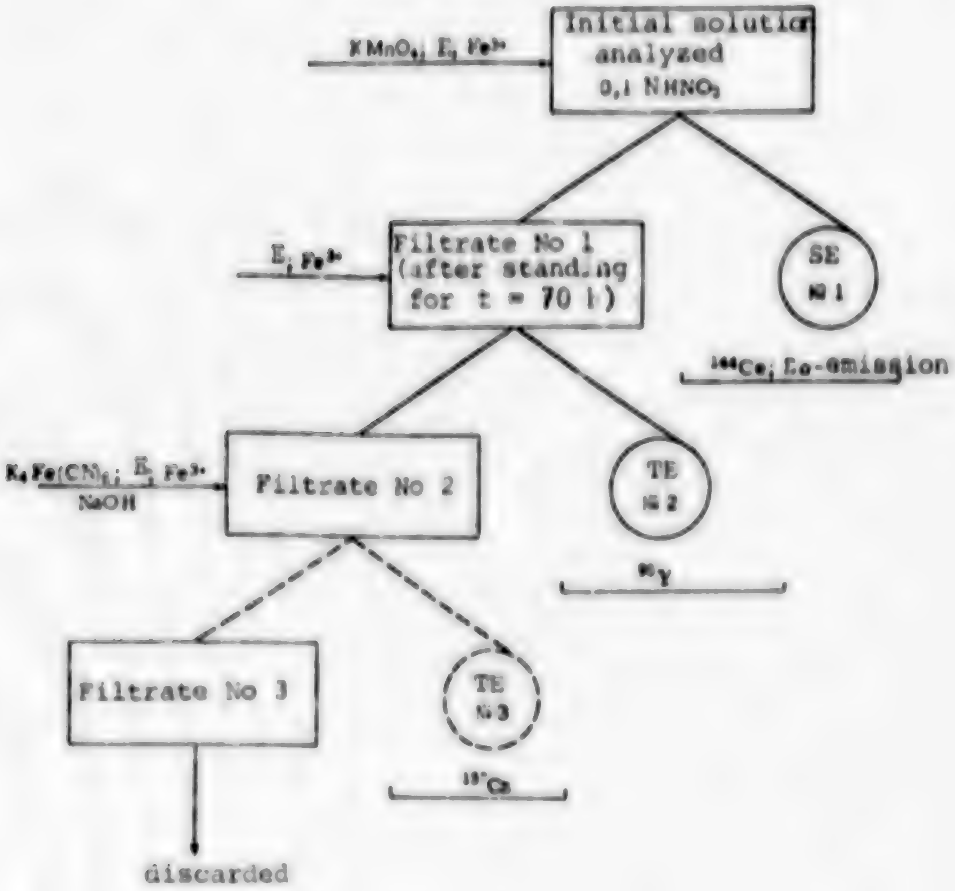


Figure 9. Diagram of analysis of radioisotopes in one sample (see Table 7)

Key:

E) solution (MIOMPA + toluene + kerosene)
SE) solid extract
t = 70h) time filtrate No 1 allowed to stand, due to need to accumulate ~50% of equiponderant ^{90}Y

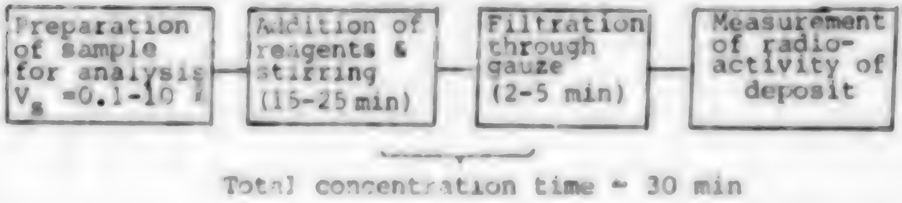

Preparation of sample for analysis V_s =0.1-10 ℓ
Addition of reagents & stirring (15-25 min)
Filtration through gauze (2-5 min)
Measurement of radioactivity of deposit
Total concentration time ~ 30 min

Figure 10. Order of procedure for analysis radioisotopes [V_s refers to sample volume]

Table 7. Amounts of reagents added per 5 ℓ solution when extracting radioisotopes from one sample[1] for analysis

Solution	Extractant & solvents,E			Fe^{3+}	$KMnO_4$	$K_4[Fe(CN)_6]$	HNO_3	NaOH	Radioisotopes assayed
	MIOMPA mℓ	toluene mℓ	kerosene mℓ	mg	mg	mg	N	mg	
Initial solution	6	2,5	0,5	100	100	-	0,1	-	$\Sigma\alpha$-emitter[2] & ^{144}Ce
Filtrate No 1	3	2,5	-	100	-	- -	-	-	^{90}Sr (according to ^{90}Y)[3]
Filtrate No 2	7	6	1,5	450	-	100	-	300	^{137}Cs[4]

[1] See Figure 9.

[2] Plutonium 239 is concentrated together with uranium and other actinides.

[3] For assay of ^{90}Sr (according to ^{90}Y) without preliminary extractions, the following are added: 5 mℓ MIOMPA, 3 mℓ toluene and 100 mg Fe^{3+}.

[4] Concentration of ^{137}Cs without preliminary extractions differs only in that alkali are not added to the analyzed solution.

The activity of solid extracts is measured according to beta emission using an end-window counter with low background; gamma radiation is measured on a scintillation spectrometer and alpha radiation on a scintillation counter.

However, measurement of alpha radiation of solid extracts involves some difficulties. The effectiveness of counting when measuring the deposit by the "thick layer" method is not great (<10%). Breakdown of the iron MIOMPate deposit with alkali to isolate plutonium makes the analysis more complicated. For this reason, liquid extraction is also used to concentrate plutonium in the methods of assaying Pu in environmental objects and biological samples. MIOMPA and isoamylpyrophosphoric acid (IAPPA) in toluene ($[H_2(i\text{-}C_5H_{11})_2P_2O_7)$) are used as extractants. The values of D for Pu III and Pu IV are in the range of 500-2000 with 0.5-1.0 m/ℓ concentration of IAPPA in toluene and 0.1-8.0 m/ℓ nitric and hydrochloride acids. This makes it possible to quantitatively extract plutonium to the organic phase with volume ratios $v_a/v_o = 50 \div 100$. Plutonium is isolaced from the organic phase on a deposite of nickel hydroxide in an alcohol medium or by re-extraction with ammonia oxalate solution. It should be borne in mind that other elements will also be extracted along with plutonium, i.e., alpha emitters such as uranium, americium and neptunium. The obtained concentrate of alpha emitters can be separated into components, if necessary, by means of other methods, for example, partition chromatography with facing [exposed?] phases.

Selective Extraction of Plutonium by Means of Partition Chromatography Columns With Facing Phases

The sorbing layer of the partition chromatography columns with facing phases consists of a ground solid carrier with hydrophobic surface, on which is applied a thin film of liquid organic extractant, virtually insoluble in water.

Upon filtration through such a column of aqueous solutions containing substances that are extractable with a given extractant, these substances are retained in the column.

The efficiency of extraction and separation in such columns is many times greater than ordinary liquid extraction, since extraction in the columns takes place under chromatographic conditions that provide for counterflow during the repeated acts of sorption and desorption of substances as the solution thereof moves in the layer of sorbent. There are many studies that were conducted with the use of this method, and they are described in surveys [17, 18].

The theoretical bases of the method of chromatographic extraction, which were developed by V. K. Markov and his colleagues, are described in detail in [19]. To extract plutonium from complex solutions, the authors of the cited work proposed a column consisting of ground shavings (or grit) of fluoroplastic, on the surface of which a film of trioctylamine (TOA) is applied.

It was found that the isotherm of distribution of tetravalent plutonium in TOA and nitric acid solutions can be described by the equation of Langmuir:

$$C_e = \frac{ABC}{1+BC} \qquad (10)$$

where C_e and C are equilibrated concentrations of Pu IV in the extractant and aqueous solution, respectively, A is maximum concentration of Pu IV in the extractant in the case of complete saturation, $B = [C_e]/[A-C][C]$ is the constant of extraction equilibrium. In the range of equilibrated [equiponderant] concentrations of Pu IV from 1 to 50 $\mu g \cdot m\ell^{-1}$, the values of the constants in equation (10) were found to be the same:

$$A \cong 98{,}000\ \mu g \cdot m\ell^{-1};\ B = 0.203$$

Dynamic activity (W) of the column, expressed as the volume of solution filtered through it up to the time that the extracted substance passes into the filtrate, should theoretically be described by the following equation, due to the convex shape of the distribution isotherm:

$$W = mD + v \qquad (11)$$

where D is the distribution coefficient corresponding to the concentration (C_0) of extracted substance in the initial solution $D = (A+B^0)/(1+BC_0)$, m is the volume of extractant in the column, in mℓ, and v is the intergranular space in the column, mℓ.

Using equation (11) and disregarding the presence of some diffusion of the actual front of substance moving along the column (theoretically it should be broken), one can calculate the approximate volume of extractant (m) required to extract substances from a specified volume of aqueous solution. Thus, with the specified values of W = 10 mℓ, $C_0 = 1 \cdot 10^{-3}\ \mu g/m\ell$ and

$v = 0.2$ mℓ, the volume of extractant is $m \approx 5 \cdot 10^{-6}$ mℓ. More precise calculation of m, with consideration of diffuse nature of the front is given in [19].

The high distribution coefficients of plutonium make it possible to extract it with infinitesimal volumes of TOA, which form a very thin film on the surface of the carrier.

This facilitates subsequent elution of plutonium from the column, which may be slower with thick films due to the slowness of diffusion processes in them.

It is significant that a change in concentration of nitric acid in the tested range from 1 to 4 N and zirconium nitrate content of up to 500 $mg \cdot ℓ^{-1}$ do not have an appreciable effect on extractability of plutonium with TOA film.

Beryllium, aluminum and iron nitrates, when present in amounts of 50 $g \cdot ℓ^{-1}$ in a nitric acid solution and presence of 200 $g \cdot ℓ^{-1}$ sodium enhance the effectiveness of extraction.

In a concentration of 50 $g \cdot ℓ^{-1}$, uranyl nitrate diminishes significantly the capacity of TOA for plutonium (IV).

The ease with which uranium in hexavalent state, americium and curium in trivalent state are retained in nitric acid solutions provides for highly effective separation of hexavalent plutonium from them. It is more difficult to separate plutonium from neptunium by this method; however, A. V. Yablochkin found conditions that provide for virtually complete separation of plutonium from this element as well. To an aliquot of solution he adds 1 M iron sulfaminate (II) to a concentration of 0.1 M and it is stirred. After about 1 min, 0.2 mℓ saturated $KBrO_3$ solution in 1.5 N HNO_3 is added per mℓ. After 20 min, the sample prepared in this manner is quantitatively transferred to a microcolumn, the walls of the beaker are rinsed in 1.5 N HNO_3, the solution is filtered thorugh the column then eluated in 3 mℓ 1.5 N HNO_3. The plutonium sorbed by the TOA film is eluated in 1 mℓ 3% ammonia oxalate in 1.5 N HNO_3, and this eluate is applied to a planchette of stainless steel to measure alpha activity. As an illustration, we submit the results of repeated analysis of two artificially prepared solutions with different concentrations of plutonium in them.

The components were present in solution in the following concentrations: 1.5 N HNO_3, 40 g/ℓ Al, 4 g/ℓ U, 35 mg/ℓ Np, 174 μg/ℓ and 1.61 μg/ℓ Pu.

The chromatography column, 3 mm in diameter, contained 0.1 g ground fluoroplastic-4 and 0.001 mℓ TOA on its surface.

On the basis of the obtained statistical data, it was found that the coefficients of variation constituted 4% and 7% in assaying concentrations of plutonium of 174 μg/ℓ and 1.61 μg/ℓ, respectively. The time required to isolate plutonium from the solutions and to assay it does not exceed 60 min.

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[0314-10,657]

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CSO: 8144/0314

UDC 628.312:576.851.315

STUDIES ON THE INTERACTION OF BDELLOVIBRIO BACTERIOVORUS WITH CHOLERA VIBRIOS IN SEWAGE WATER

Moscow GIGIYENA I SANITARIYA in Russian No 10, 1979 pp 82-84

[Article by E. A. Moskovitina, D. T. Shiryayev, L. V. Ivanova, A. I. Talalayev, and A. A. Shaposhnikov, Scientific Research Institute of Antiplagues, Rostov na Donu, submitted 16 September 1978]

[Text] The purpose of our studies was to isolate Bdellovibrio bacteriovorus under natural conditions, to reveal among them the strains which are most active with respect to El-Tor cholera vibrios of the Ogawa and Inaba serotypes, and to determine the interaction of Bdellovibrios possessing a high lytic activity with cholera vibrios in native and autoclaved sewage. Another goal of our studies was also to show the possibility of using Bdellovibrio bacteriovorus as a natural biological agent for decontamination of sewage water during the stages of biological purification or in a closed sewer system.

In order to isolate Bdellovibrio bacteriovorus, we used the method of cultivating bdellovibrios with the use of the host microbe in the state of diminished vital activity (F. Kh. Ibragimov et al; F. Kh. Ibragimov). The test microbes were the coliform bacterium (E. coli 469) and El-Tor cholera vibrios of the serotypes Inaba 8860 and Ogawa 9596. The studies were conducted during the spring-summer season. In order to isolate Bdellovibrio bacteriovorus, water was taken from the Don, Temernik, at the places of the discharge of unpurified household sewage, and during various stages of biological purification. A 0.7% agar-agar gel pH 7.2-7.4, Gelen's medium, pH 7.4, and Marten's agar, pH 7.2, were used in the experiments.

The determination of the interaction of the strains of Bdellovibrio bacteriovorus with cholera vibrios in the native and autoclaved sewage water at temperatures of 22 and 37 degrees C was done by adding cholera vibrions into it at a ratio of $4.0 \cdot 10^5$ microbe cells in millimeters and Bdellovibrio bactteriovorus with an index of from $4.8 \cdot 10^5$ to 6.2×10^5 BOYe/ml. The control was the same samples, but with the addition of only cholera vibrios or bdellovibrios in the same amounts. Every 24 hours, the number of cells of cholera vibrios was determined in the experimental and control samples by the method of counting live microorganisms (Dzh. Meynell and E. Meynell) and the bdellovibrio index (F. Kh. Ibragimov).

The control of the samples for the presence of parasitic microorganisms was done by means of a phase-contrast miscroscope. The specificity of the lysis was confirmed by the presence of bdellovibrios with their characteristic type of mobility in the samples. The coli-titer, coli-index, overall microbic insemination and physicochemical properties of sewage water were determined in accordance with the existing methods (Yu. Yu. Lur'ye and A. I. Rybnikova). Statistical processing of the material was done according to the methods of I. P. Ashmarin and A. A. Vorob'yev.

In order to isolate the Bdellovibrio bacteriovorus, we studied 86 samples from various environmental objects. The sewage water was characterized by an alkaline reaction of the medium (from 7.1 to 7.6), the presence of ammonium (from 2.0 to 10.0 mg/l) and nitrite (from 0.002 to 0.2 mg/l) nitrogen, sulfates (323.0-396.4 mg/l), the oxidizability of the oxygen in the samples varied from 31.1 to 47.5 mg/l, the microbe number varied from 9800 to 270,000, and the coli titer from 0.0001 to 0.000004.

Bdellovibrio bacteriovorus was isolated from 42 (48.6%) samples and the largest number of parasitic microbes was contained in sewage water during purification stages (in 73.3% of the samples). The bdellovibrio index varied from $3.0 \cdot 10^3$ to $1.3 \cdot 10^5$ BOYe/ml. The persentage of the bdellovibrio isolation on cholera vibrios was 56%, and on coliform bacteria 47.4%, which indicated a more marked lytic activity of the isolated strains in relation to cholera vibrios.

Among the 42 isolated strains of Bdellovibrio bacteriovorus, we selected seven strains which had the highest lytic activity with respect to El-Tor cholera vibrios of the Ogawa and Inaba serotypes. This was indicated by the absence of even single cells of cholera vibrios during joint vegetation after 4-5 days, while the number of cholera vibrios remained considerable ($4.0 \cdot 10^4$ - $5.0 \cdot 10^5$ in 1 ml) in the control (without bdellovibrios).

One of these strains -- Bdellovibrio bacteriovorus 68NS-4 -- was used in the experiments on the interaction with cholera vibrios in sewage water. In native sewage water, the destruction of cholera vibrios of the Ogawa serotype occurred on the fourth day, and the bdellovibrio titer varied from $3.4 \cdot 10^4$ to $6.4 \cdot 10^4$ BOYe/ml. The lytic effect of bdellovibrios on the strains of cholera vibrios of the Inaba serotype showed itself on the third-fourth day with titers of $7.0 \cdot 10^4$ and $1.4 \cdot 10^4$ BOYe/ml. The destruction of cholera vibrios in the control occurred during the same period.

Water from the sewage where a two-component parasite-host system was introduced was also characterized by a high degree of microbic insemination (from $1.7 \cdot 10^4$ to $2.4 \cdot 10^3$). Therefore, in our opinion, the destruction of the El-Tor cholera vibrios of both serotypes in native sewage water occurred during the same periods both in the experimental and in the control samples, on the one hand, due to the lytic effect of Bdellovibrio bacteriovorus, and on the other hand, due to the antagonistic effect of the accompanying microflora and bdellovibrios contained in the water under study.

In the autoclaved sewage water, there was a sufficiently clear lytic effect of bdellovibrios on the El-Tor cholera vibrios of both serotypes at temperatures of 22 and 37 degrees C, which was indicated by the destruction of El-Tor cholera vibrios of the Inaba and Ogawa serotypes on the seventh-tenth day at 22 degrees C and on the fourth-sixth day at 37 degrees C. At 22 degrees C, the destruction of cholera vibrios occurred at bdellovibrio titers of $3.7 \cdot 10^4$ and $4.6 \cdot 10^4$ BOYe/ml, and at 37 degrees C, the titer was, respectively, $5.1 \cdot 10^6$ and $2.4 \cdot 10^6$ BOYe/ml. In the control samples, cholera vibrios were preserved to the tenth day, and their amount remained at a level of $1.5 \cdot 10^3$ to $1.0 \cdot 10^6$ in 1 ml.

During the interaction with cholera vibrios the titer curve of Bdellovibrio bacteriovorus had the shape of a broken line rising and falling periodically. The presence of bdellovibrios after the destruction of cholera vibrios cultivated at 22 and 37 degrees C confirmed the ability of parasitic bacteria to develop at the expense of destructed cells of the host.

Thus, the lysis of the cells of cholera vibrios during the interaction with Bdellovibrio bacteriovorus progressed most effectively at 37 degrees C, i. e., at the temperature which is the most optimal for the growth and multiplication of cholera vibrios.

The time of the establishment of the maximum value of the parasite-host ratio is the index of the rate of the interaction process in the system (A. V. Afinogenova and V. A. Lambina). In our experiments, the parasite-host ratio was established most rapidly during the interaction of bdellovibrio and El-Tor cholera vibrios of the Inaba and Ogawa serotypes at 37 degrees C. For example, after 24 hours of incubation at this temperature, the parasite-host ratio for El-Tor cholera vibrios of the Ogawa serotype was $0.2 \cdot 10^5$, and for El-Tor cholera vibrios of the Inaba serotype -- $0.3 \cdot 10^5$, while at a temperature of 22 degrees C, it was, respectively, $0.7 \cdot 10^3$ and $0.8 \cdot 10^3$. The maximum parasite-host ratio was established during the interaction of bdellovibrio with cholera vibrios at 37 degrees C on the third day, and at 22 degrees C -- on the seventh day, i.e., more time is required for the establishing of the maximum ratio at a lower temperature of incubation. In our opinion, this can explain later periods of destruction of cholera vibrios at 22 degrees C than at 37 degrees C.

Conclusions

1. Strains of Bdellovibrio bacteriovorus possessing a high degree of lytic activity in relation to El-Tor cholera vibrios of the serotypes Ogawa 9596 and Inaba 8860 were isolated from sewage water.

2. When Bdellovibrio bacteriovorus interacted with El-Tor cholera vibrios of the Ogawa and Inaba serotypes in autoclaved sewage water, the ant gonistic effect of the parasite showed itself on the fourth-sixth day at 37 degrees C and on the seventh-tenth day at 22 degrees C.

3. In native sewage water, the destruction of El-Tor cholera vibrios of both serotypes occurred on the third-fourth day at 22 degrees C both in the experimental and in the control samples. In this connection, the possibility of using Bdellovibrio bacteriovorus as biological agents for the decontamination of sewage water from cholera vibrios requires further study.

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EFFECT OF AUDITORY FATIGUE ON SPEECH PERCEPTION IN THE PRESENCE OF INTENSIVE LOW-FREQUENCY NOISE

Moscow VOYENNO-MEDITSINSKIY ZHURNAL in Russian No 6, 1975 pp 56-57

[Article by A. G. Antonov, candidate of medical sciences, Capt Med Ser; B. V. Ovchinnikov, Sr Lt Med Serv; and A. S. Permyakov, Engr-Maj, submitted Jul 74]

[Text] Rapid and accurate auditory reception of verbal signals is an important indicator of the fitness of numerous categories of operators who use communication equipment. Not infrequently, the work of this group of personnel is performed against the background of intensive noise interference, which is most often of a low frequency (noise of engines, landing [running] gear, external equipment, etc.).

It is known that low-frequency noise has a powerful masking effect on the sounds of speech (Fletcher, 1929; Miller, 1947) and, moreover, it leads to a significant elevation of thresholds of auditory sensibility over a wide range of frequencies (L. N. Tumarkina, 1955; R. I. Chernyak, 1958). Long-term exposure to low-frequency noise causes a complex functional change in the auditory system, as a result of which there is impairment of perception of useful auditory signals (K. L. Khilov et al., 1968).

It is impossible to substantiate medical and technical measures to assure good and stable communications in combat equipment [material] without determining the degree and nature of correlation between the adaptive changes in the auditory analyzer and quality of perception of verbal signals against the background of noise. For this reason, we studied the influence of functional changes in the auditory system on clarity of speech in the presence of intensive low-frequency noise. There was a total of 36 operators participating in these studies; they had normal hearing and were exposed during their work to low-frequency noise in excess of 110 dB with maximum level of sonic energy in the frequency range of 20-160 Hz. The subjects ranged in age from 18 to 22 years. They were exposed to noise continuously for 10 to 30 h over a 2-day work period (for 2-3 h at a time with about 1-h intervals), 22 subjects being tested with the shorter exposure and 14 with the longer one.

The intelligibility of speech in transmission of signals over an intercom was tested by the GOST 16600-72 method. At first, the operators underwent conditioning. The coefficient of verbal intelligibility--an index that reflects the most adequately the quality of professional performance--served as the parameter for evaluation. Its value was calculated as a percentage of the ratio of correctly perceived and recorded words to the total number of transmitted words listed on the articulation table. In each experiment, the articulational measurements were taken twice: immediately after the start of exposure to noise and just prior to discontinuation thereof.

The changes in functional state of the auditory system were identified by comparing the indices of threshold tonal audiometry obtained before and after exposure to noise. Loss of binaural hearing function was calculated by the method recommended by A. P. Veletskiy (1972), taking into consideration the shifts in thresholds of audibility at frequencies of 500, 1000, 2000 and 4000 Hz. The results of the audiometric tests were compared to the articulation readings, with calculation of the coefficient of correlation.

It was established that the decline of the coefficient of verbal intelligibility reached 18% by the end of the experiments, as compared to the base value. The impairment of speech perception was associated with marked adaptive changes in the auditory system (according to audiometry findings). Loss of binaural hearing after exposure to noise reached 44.3%. As shown by repeated audiometry, the thresholds of audibility were entirely restored on the 2d-3d day after discontinuing exposure to noise. We are justified in attributing such substantial and persistent functional changes in the auditory system to auditory fatigue, which the operators developed as a result of prolonged and intensive sonic stimulation (G. V. Gershuni, 1949).

A comparison of the audiometric findings to the results of articulation measurements revealed that there is a close correlation between percentage of hearing loss and coefficient of verbal intelligibility. The coefficient of correlation constituted 0.75. The correlation between these parameters was found to be statistically significant ($P < 0.01$). Even in the case of virtually undiminished hearing (loss of up to 10%), the coefficient of intelligibility decreased to 92.8%. This level of intelligibility, which still provides for perception of speech without any difficulty, also persists when operator hearing loss increases to 20%. Evidently, the drop of the coefficient in question in the presence of normal hearing or slight loss therein is related to the masking effect of low-frequency noise.

In the case of over 20% hearing loss, the coefficient of verbal intelligibility drops significantly. Thus, 30-40% hearing loss, which is not subjectively noticed in everyday life and is not classified as hypacusis, leads to great difficulty in verbal communication in the presence of low-frequency noise (coefficient of verbal intelligibility is 79.4%). In such cases, proper speech perception requires very intensive attention, requests to repeat the words and repetitions, which is often inadmissible, particularly in the case of operators working on a very tight schedule. The results we obtained make it possible to relate quantitatively the magnitude of functional change in the auditory system to the quality of operator performance on jobs involving audio contact. This makes it possible to set standards for acoustic conditions of work for preset levels of quality of communications in combat material and to substantiate the specifications for engineering parameters of intercom equipment that is intended for operation in the presence of intensive low-frequency noise.

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TOXICITY OF SINGLE AND MULTIPLE INJECTIONS OF CERTAIN RADIOPROTECTIVE PHOSPHORUS-CONTAINING DERIVATIVES OF ISOTHIOURONIUM

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian No 2, 1980 pp 212-215

ZAV'YALOV, Yu. V., and YAKOVLEVA, N. D., Laboratory of Radiation Pharmacology and Experimental Pathomorphology, Institute of Medical Radiology, Academy of Medical Sciences USSR, Obninsk

[Abstract] Studies were conducted on the relative toxicities of the ethylphosphate, diethylphosphate, and metaphosphate derivatives of S-ethylisothiouronium in female mice and Wistar rats. The LD_{50} values for these compounds in mice on intraperitoneal, subcutaneous, and intramuscular injection ranged from 455 to 772 mg/kg, while on intragastric administration the range was from 2100 to 2490 mg/kg. On intraperitoneal administration these agents were more toxic for the rats (LD_{50} = 113 to 425 mg/kg) than for the mice (LD_{50} = 455-510 mg/kg). Daily intramuscular administration of these radioprotective for 10 days (0.2 mM/kg/day) did not affect the behvaior of the animals or have any pathoanatomic sequelae. Figures 3; References 12: 4 Western, 8 Russian.
[301-12172]

UDC 576.312.33:577.39:599.8

COMPARATIVE STUDY OF RADIOSENSITIVITY OF MONKEY CHROMOSOMES UNDER IN VIVO AND IN VITRO IRRADIATION OF CELLS

Moscow GENETIKA in Russian Vol 15, No 9, 1979 pp 1661-1693 manuscript received 23 Oct 78 after revision of 7 Aug 78 version

DZHEMILEV, Z. A., Institute of Experimental Pathology and Therapy, USSR Academy of Medical Sciences, Sukhumi

[Abstract] Stressing the eminent usefulness of cytogenetic studies on monkeys as models for insight into related human problems, the need is cited for in vivo studies on chromosome radiosensitivity to support extrapolation of such studies to man. The present work was designed as a comparative analysis of the frequency of chromosome aberration in Macaca mulatta monkeys under irradiation of their somatic cells in vivo and in vitro. Males, 7-12 yrs, were used in these experiments; cells studied were peripheral blood lymphocytes and renal epithelial cells. In the in vivo tests the animals were subjected to 100 r gamma radiation; for in vitro tests blood was taken--prior to the in vivo irradiation--for irradiation of the lymphocytes. For the in vitro renal cell irradiation, same dose, cell cultures were used from other monkeys. Conditions of

radiation were the same for both in vivo and in vitro irradiation. Analysis for chromosome aberration followed Dzhemilev's procedure described earlier (1970, 1976, 1977). Results indicated essentially no differences in aberration yield in these cells under in vivo or in vitro exposure. References 8: 4 Russian, 4 Western.
[18-8586]

UDC 575.23:576.312.33:599.8

FREQUENCY OF RADIATION-INDUCED EXCHANGES IN READILY IDENTIFIABLE CHROMOSOMES IN MONKEYS

Kiev TSITOLOGIYA I GENETIKA in Russian No 6, 1979 pp 435-437 manuscript received 8 Aug 78

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[Abstract] Chromosome aberrations in homologous pairs 1, 2, 3, 4, 8, 9 and 20, involved in formation of dicentrics, were determined in primary cell cultures of adult Macaca mulatta and Papio hamadryas kidneys irradiated in vitro at G_0 with 200 R. No significant species-related differences in radiosensitivity were found. M. mulatta cells contained 197 dicentric chromosomes and P. hamadryas cells 167. The frequency of involvement of chromosomes 1, 2, 3, 4, 8, 9 and 20 in asymmetric exchange was proportional to their length. Thus, the frequency of radiation-induced exchanges was proportional to genome size. Chromosome 1, which has less chromatin than chromosome 2, was involved twice as often in exchanges as chromosome 2, which does not suggest preferential localization of radiation-induced damage in heterochromatic regions. References 7: 7 Russian.
[135-9307]

UDC 575.111:576.312.36:599.824

TETRAPLOIDY IN EPITHELIAL KIDNEY CELLS IN MONKEYS EXPOSED IN VIVO AND IN VITRO TO DIFFERENT RADIATION DOSES: PART III

Kiev TSITOLOGIYA I GENETIKA in Russian No 6, 1979 pp 446-451 manuscript received 15 Aug 78

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[Abstract] Epithelian kidney cell cultures from Macaca mulatta were irradiated in vitro at G_0 once in doses of 25, 50, 100, 200 and 400 R. Monkeys (1-3-years old) were irradiated in vivo with 620-660 R

(^{60}Co, gamma unit); cell cultures were obtained from these 0.5, 2 and 10 months after irradiation. Only tetraploid cells with 80-84 chromosomes were studied. In the 3-day culture, there was an increase in the number of tetraploid cells from 3.0% (25 R in vitro) to 5.1% (200 R) in comparison with the 0.8% control value. In the 5-day cultures (25-200 R), the number of tetraploids tended to increase to 8.4%, perhaps owing to culture senescence, as well as radiation. In vivo irradiation caused a significant increase in simple and complex (endoreduplicants) (EDR) tetraploid cells to 11.1% (0.9% in control) after 10 months. EDR cells comprised about 4.2-6.4% and simple tetraploids 1.8-1.9% 0.5-2 months after in vivo irradiation. After 10 months, there were 7.5% simple tetraploids and EDR cells decreased to 3.3%, which demonstrates the elimination of the most radiation-damaged cells. The data on radiation damage in monkeys, a model most similar to humans, may be used to supplement the WHO recommendations on biological dosimetry based on lymphocyte tetraploidy, since the radiosensitivity of the monkey kidney cells and peripheral plood lymphocytes was found to be similar. Figures 2; references 19: 1 Czech, 14 Russian, 4 Western.
[135-9307]

UDC 616-001.34:534.321.8]-057-092

EARLY REACTION OF THE ORGANISM TO LOW FREQUENCY ACOUSTICAL OSCILLATIONS

Moscow GIGYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 10, Oct 79 pp 16-19 manuscript received 13 Feb 78

KARPOVA, N. I., ALEKSEYEV, S. V., YEROKHIN, V. N., KADYSKINA, YE. N., REUTOV, O. V., Leningrad Sanitary-Hygienic Medical Institute

[Abstract] The authors' institute is engaged in a project involving gathering of data on sources of infrasound, determination of the nature of its action on the organism and determination of the mechanism of the changes observed in the organism under the infulence of infrasound oscillations. This article involves determination of the very earliest reactions of the organism to this production factor. Studies were performed by modeling production infrasound parameters in an experimental acoustical complex. The experiments were performed on healthy male volunteers 19 to 29 years of age and also on rats, rabbits and guinea pigs. Sound frequencies used were 5 and 10 Hz, sound pressures 100 and 135 dB, exposure time 15 minutes. Within the first minutes, mental stress, autonomic reactions and unpleasant auditory sensations were noted, as well as feeling of general fatigue, weakness and pressure in the ears. Some 15 to 20% of the human subjects developed such symptoms as headache and dizziness. More than half complained of confusion, sleepiness and feeling of depression. Some felt vibration of the internal organs. The use of EEG, EKG, seismocardiography, pneumocardiography and audiometry

indicates that infrasound primarily causes disorders of the mechanisms of central regulation of the cardiovascular and respiratory systems, and disrupts protein synthesis and metabolic processes in the organism. References 8: 5 Russian, 3 Western.
[558-6508]

UDC 616-001.34-057.036.8

DYNAMICS OF VIBRATION DISEASE AFTER CESSATION OF CONTACT WITH VIBRATION

Moscow GIGYENA TRUDA I PROFESSIONAL'NYYE ZABOLEVANIYA in Russian No 10, Oct 79 pp 40-41 manuscript received 26 Jan 79

CHAGELISHVILI, A. D., LABADZE, P. F., TOGONIDZE, T. V., KHAVTASI, A. A., KAKULIYA, T. A., Tbilisi Institute of Labor Hygiene and Occupational Diseases

[Abstract] Dynamic observations were performed on 158 patients with vibration disease over a period of 5 years (1972-1976). The subjects were mostly males 30 to 49 years of age, who had worked for 11 years or more under conditions of exposure to vibration. Capillary spasm was observed in all patients, as well as vibration sensitivity and elongation of the time of the cold test. In spite of active combined therapy, complete rehabilitation was not observed over the period of 5 years; partial rehabilitation was observed in 20% of the subjects. The pathologic process stabilized in 41% of the patients but subjective and objective symptoms progressed in 39%. Stabilization is considered to be primarily due to cessation of contact with vibration, while reversal of the pathologic process is hindered by accompanying diseases such as chronic gastritis, cholecystitis and hypertension.
[558-6508]

PHYSIOLOGY

THE MODELING OF SOME FUNCTIONS OF HUMAN VISION

Moscow BIOFIZIKA in Russian Vol 25, No 1, Jan/Feb 80 pp 153-158 manuscript received 22 Feb 79

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[Abstract] The following vision functions were modeled: formation of an empty field with stabilization of grid projection; space integration, i.e., filling of empty fields with retention of high resolution capability; observation of the so-called "comets" during artificial translocation of stabilized grid images and the effect of illumination of the far periphery of the grid on the visible brightness. The following characteristics of the model were noted: the contour signal represents a Laplasian of the initial image; this Laplasian is obtained by the drift of the visual axes of the eyes. The signal from each receptor proceeds along two parallel channels, one of which is a low frequency channel and the other - a high frequency supplemental channel with the filter F. Filling of the empty fields is performed by spacial integration. Figure 1, references 7: all Russian.
[266-7813]

UDC 612:51.001.57

SELF-REGULATORY CHARACTERISTICS OF THE HUMAN CARDIOVASCULAR SYSTEM IN CLINO- AND ORTHOSTASIS (MATHEMATICAL MODELING)

Kiev FIZIOLOGICHESKIY ZHURNAL in Russian No 1, 1980 pp 96-103 manuscript received 29 Jun 78

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[Abstract] A mathematical model based on an ALGOL program for a BEhSM-6 high-speed computer is proposed for the human cardiovascular system reacting to a 10-s ortho test with the condition of closed neuroreflex links. This model takes into account the self-regulatory characteristics of the heart and resistance--capacitance properties of vessels. It was used to analyze the sensitivity of minute blood volume (Q) and mean arterial pressure (P_A) to changes in heart rate (F), inotropic state of the heart (k), total peripheral resistance, and relaxed volume (U) and inflexibility (D) of the venous pool during clino- and orthostasis. In both states, Q and P_A were most sensitive to change in U. With a shift to the vertical position, sensitivity of Q and P_A to k and F decreased and their sensitivity to changes in D increased markedly. During orthostasis, blood volume and pressure in central regions of the cardiovascular system decreased and

blood flow was reduced. Brain circulation decreased parallel to Q after 3 s of orthostasis. Total peripheral resistance increased by 8%. These changes are attributed to the pronounced drainage of blood from the upper to the lower regions of the vascular system. According to the model, circulation is regulated by a variable control structure which takes into account cardiac and vascular parameters and affects the function of other body systems. Figures 3; references 17: 9 Russian, 8 Western.
[236-9307]

UDC 612.821

THE DYNAMICS OF AUTONOMIC REACTIONS IN VOLUNTARY CONTROL OF ALPHA-RHYTHM

Moscow FIZIOLOGIYA CHELOVEKA in Russian Vol 5, No 5, May 1979 pp 927-930
manuscript received 5 Dec 77

MARKMAN, V. G., Institute of Physiology imeni I. P. Pavlov of the USSR Academy of Sciences, Leningrad

[Abstract] Interaction among parameters of alpha-rhythm intensity during voluntary control, heart rate and galvanic skin response was studied among two groups of five test subjects each. Feedback experiments helped the test subjects to control alpha-rhythm, with a corresponding increase of heart rate. The increase of alpha-rhythm is shown to be an emotional response to the feedback signal. The differences of the test subjects show the differences of the functional organization of hypothalamic and cortical relationships and may be used for preliminary separation of test subjects in occupational selection. Figures 1; references 8: 8 Russian.
[9844/0343]

UDC 62-50:611.8

STRUCTURAL THEORIES OF THE ORGANIZATION OF THE NERVOUS SYSTEM

Moscow AVTOMATIKA I TELEMEKHANIKA in Russian No 11, 1979 pp 152-160
manuscript received 27 Nov 78

GOROZHANIN, V. S., Kustanay

[Abstract] A new approach to a formal description of the functioning of the brain is proposed. The approach is based on considering such cerebral structures (blocks) as the neocortex, the hypothalamus, the reticular formation, etc., which differ functionally and morphologically, rather than such smaller elements as neurons, gliocytes, and synaptic endings,

or the brain as a whole. This approach logically entails the use of methods of the control theory, since the isolation of discrete structures or units or blocks and their interconnections, can result in analysis of the behavior of the system as a whole as in control theory. It is shown that a large number of such diverse problems of neurophysiology as the origin of individual differences in the properties of the nervous system, the genesis of evoked brain potentials and biological rhythms, and the rise of pathological states can be substantively interpreted in terms of the control theory. Then, moreover, in some cases the language of control theory proves to be more adequate than biological terms proper (in analysis of the EEG rhythm assimilation response and of evoked brain potentials). Figures 2; references 18: 16 Russian, 2 Western.
[159-1386]

UDC 612.822.3+591.51

INTERACTION BETWEEN THE HIPPOCAMPUS AND THE POSTERIOR HYPOTHALAMUS IN ACCOMPLISHING THE ORIENTATION REFLEX

Moscow ZHURNAL VYSSHEY NERVNOY DEYATEL'NOSTI in Russian Vol 29, No 3, May-Jun 1979 pp 605-612 manuscript received 1 Mar 78

BORAVOVA, A. I., Brain Institute of the USSR Academy of Medical Sciences, Moscow

[Abstract] Electrical stimulation was used to study the internal relationships of the hippocampus and posterior hypothalamus in chronic and acute experiments on 13 rabbits 3 to 3.5 months of age. Electrical stimulation of the posterior hypothalamus caused orienting behavior in the form of alertness and orienting motions with sniffing and listening in the test animals. There is a different latent period of orienting behavior depending on the intensity and length of the stimulating current and also on the location of the electrical stimulus. Neurons of the hippocampus with lower and higher level of activity have less ability to modulate the discharges during electrical stimulation of the posterior hypothalamus. Electrical stimulation of the hypothalamus, accompanied by the occurrence of orienting behavior, alters the pulse activity of a considerable number of hippocampic cells. Tonic activation and inhibition responses with long aftereffect are a dominant type of response. The nonspecific nature of responses of the hippocampic cells to electrical stimulation of the posterior hypothalamus indicate functional manifestations of hypothalamic afferentation, which rises in the dorsal hippocampus during orienting behavior. Figures 4, references 20: 12 Russian, 8 Western.
[9844/0363]

UDC 612.833.3-063:612.826.4

EFFECT OF TETANUS TOXIN ON NOREPINEPHRINE RELEASE BY RAT BRAIN SYNAPTOSOMES

Moscow BYULLETEN' EKSPERIMENTAL'NOY BIOLOGII I MEDITSINY in Russian No 2, 1980 pp 148-150 manuscript received 19 Jan 79

KRYZHANOVSKIY, G. N., RODINA, V. I., GLEBOV, R. N. and BAZYAN, A. S., Moscow, Institute of General Pathology and Pathological Physiology, USSR Academy of Medical Sciences

[Abstract] The effect of purified tetanus toxin (TT) on the release of both endogenous and exogenous (^{14}C-tagged) norepinephrine from rat brain synaptosomes was investigated. The synaptosomes used in the experiments were isolated from the cerebral tissue of white rats. It was found that purified TT (80-800 Dlm/mg protein) causes enhanced secretion of both endogenous and exogenous norepinephrine from the synaptosomes and does not inhibit the secretion of norepinephrine due to depolarizing agents. Both these effects are here described for the first time, and both these effects become completely inhibited upon inactivating TT with anti-tetanus serum. Thus while TT is known to inhibit the release of glycine, acetyl choline, and dopamine from presynaptic terminals, it contrariwise stimulates the release of norepinephrine from synaptosomes. The mechanism of this phenomenon remains as yet unclear. Figures 2; references 15: 5 Russian, 10 Western.
[248-1386]

UDC 612.014.461.2

CHARACTERISTICS OF RESPIRATION, BLOOD CIRCULATION AND OXYGEN REGIMES IN HUMANS DURING HYPERBARIC HYPEROXIA

Kiev FIZIOLOGICHESKIY ZHURNAL in Russian No 1, 1980 pp 45-52 manuscript recieved 11 Dec 78

GULYAR, S. A., Division of Hypoxic States, A. A. Bogomolets Institute of Physiology, Ukrainian Academy of Sciences, Kiev

[Abstract] Interrelations of basic respiratory and hemodynamic parameters determining oxygen transport were studied in 32 divers (22-33 years of age) for 2 hrs in a helium-oxygen environment containing 20.9 and 13.3% O_2 at 2.5 and 4 kgf/cm^2 (P_{O_2} = 384 and 204 and 618 and 393 mm Hg, respectively). An experimental setup "Barograf" was designed in which the gas mixture supply to test subjects was controlled remotely and respiration and circulation parameters were monitored directly. During rest hyperbaric hyperoxia did not cause any significant changes in body oxygen demand, minute volume or respiration frequency. Respiratory volume and physiologic

dead space increased. The ratio of alveolar to pulmonary ventilation did not change. Partial CO_2 pressure in alveoli did not change at 2.5 kgf/cm^2, but increased by 7.5% at a P_{O_2} of 618 mm Hg. The basic mechanism for reduction in minute blood volume (14.9-19.2%) during hyperbaric hypoxia was the increase in total peripheral resistance (29.7-32.9%). Bradycardia and reduction in systolic volume had a less important role. The ventilation/perfusion ratio was highest at 4 kgf/cm^2 and exceeded base values by 40.5-42.1%. Respiratory and hemodynamic shifts were caused by an increase in arterial blood oxygen tension resulting from an increase in oxygen diffusion in plasma and the more complete saturation of hemoglobin with oxygen. The rate of oxygen entry into the respiratory tract and alveoli increased by 164.7-361.1% and 170.8-371.3% at 2.5 and 4 kgf/cm^2, respectively, and the rate of its transport in arterial and mixed venous blood decreased. Body oxygen efficiency and effectiveness were reduced at the stage of oxygen entry into lungs and increased at the stage of its transport by blood. The reduction of the oxygen content in inspired air promotes normalization of the body oxygen regime; however, normal oxygen mixtures may be physiologically optimal for this pressure range. Figures 1; references 17: 10 Russian, 7 Western.
[236-9307]

UDC 612.014.461.2

GAS CHROMATOGRAPHIC INVESTIGATION OF BLOOD RESPIRATORY FUNCTION IN HUMANS UNDER HYPERBARIC CONDITIONS

Kiev FIZIOLOGICHESKIY ZHURNAL in Russian No 1, 1980 pp 57-82 manuscript received 28 Feb 78

GULYAR, S. A., KOROL, A. N. and MOISEENKO, Ye. V., Division of Hypoxic States, A. A. Bogomolets Institute of Physiology, Ukrainian Academy of Sciences; L. V. Pisarzhevskiy Institute of Physical Chemistry, Ukrainian Academy of Sciences, Kiev

[Abstract] A gas chromatograph with a catharometer was used in an analytical unit within its barometric chamber. Gases were isolated from blood in an extraction chamber chemically with the use of the Van Slyke reagent and by a gas chromatograph consisting of two columns. Nitrogen and oxygen were separated on a column with 5A molecular sieves and nitrogen with oxygen and CO_2 on a silica-gel column. Quantitation was carried out by absolute calibration based on peak heights with the use of formulas. As the pressure of gas increased, C_aO_2 and P_{O_2} increased, and at 4 kgf/cm^2 C_aO_2 surpassed base level by 17.8%. At 6.5 kgf/cm^2 with the use of the nitrogen-oxygen respiration mixture, C_aO_2 increased only by 7.5%. C_aO_2 remained elevated also after decompression. The increase in C_aO_2 is due to the more complete saturation of hemoglobin with oxygen and also the increase in physical diffusion of oxygen in plasma. Reduction of P_{O_2} of

of the inspired gas mixture reduced C_aO_2. There were no changes in the ratios of blood buffer parameters; this, together with a shift to an acid pH and increase in C_aCo_2 and P_aCO_2, indicates that short-term exposure to hyperbaric conditions provokes respiratory acidosis but does not cause any metabolic shifts. The increase in C_aO_2 but not in C_aCO_2 and pH under normal pressure with an air mixture containing 43.9 and 98% oxygen indicates that the oxygen blockade of hemoglobin is not a basic factor in the increase in blood CO_2 tension at a higher pressure. During inhalation of a hyperoxic mixture, C_aCO_2 decreases slightly because of hyperventilation with minor changes in other acid-base balance parameters and a reduction of C_aN_2. Figures 2; references 24: 7 Russian, 17 Western.
[236-9307]

UDC 612.58

HEAT PRODUCTION OF ISOLATED SKELETAL MUSCLES OF ALBINO RATS ACCLIMATED TO COLD

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR in Russian No 4, 1978 pp 543- 49
manuscript received 23 May 77

SOBOLEV, V. I., Chair of Human and Animal Physiology (Chairman S. A. Pevnyy), Donetsk State University

[Abstract] In experiments on two groups of albino rats, cold-acclimated and controls, using a calorimeter of special construction with selected sensitivity of 0.65 mcal/mm and measurement time constant 20 sec, a study was made of the production of heat within isolated skeletal muscles (m. extensor digitorum longus). Measurements of heat production were carried out under aerobic conditions at 37°. Experiments showed that upon the 3-second isometric tetanus the heat production of muscles in cold-acclimated animals was 56.2±2.8 and in non-acclimated ones 45.6±3.9 mcal/sec/g. A preliminary injection of noradrenaline (0.4 mg/kg) caused a 29.9% increase of heat production of isometrically contracting muscles only in cold-acclimated animals (from 56.2±2.8 to 68.2±3.8 mcal/sec/g). The cooling of this group of animals to rectal temperature of 35° was also accompanied by increase in contractile muscle thermogenesis. Figures 2, tables 3, references 13: 12 Russian, 1 Western.
[241-1015]

UDC 612.745+612.4

HEAT PRODUCTION OF ISOLATED SKELETAL MUSCLES OF ALBINO RATS IN EXPERIMENTAL HYPER- AND HYPOTHYROIDISM

Leningrad FIZIOLOGICHESKIY ZHURNAL SSSR in Russian No 2, 1978 pp 177-183
manuscript received 6 Apr 77

SOBOLEV, V. I., Chair of Human and Animal Physiology (Chairman S. A. Pevnyy) State University, Donetsk

[Abstract] A study of the heat production of isolated skeletal muscles (m. extensor digitorum longus) of albino rats was carried out under conditions of experimental hyper- and hypothyroidism and under the effect of catecholamines, using a microcalorimeter of special construction with parameters: sensitivity 0.41 mcal/mm, measurement time constant 20 sec. Three groups of adult male rats with average weight of 200 g were used. In the first group of animals experimental hyperthyroidism was induced by introducing per os 30 mcg/kg of triiodothyronine for 10 days. In rats of the second group experimental hypothyroidism was brought about by introducing per os 20 mg/kg of antithyroid preparation mercazolyl for 20 days. The third group served as a control. The total heat production was measured in all animals isometrically. In a part of rats of each group the given index was determined also after a preliminary (30 min before experiment) introduction of catecholamines (in vivo, I. V.): adrenaline (0.3 mg/kg) and noradrenaline (0.3 mg/kg). Results of measurements of heat production of isolated muscles of rats at 23-25° showed that experimental hyperthyroidism was accompanied by noticeable increase of heat production (+35.3%). Analysis of dependence between rectal temperature and individual values of heat production of investigated muscles showed a connection between these indices: the higher rectal temperature (that is the higher thyrotoxicosis) the greater muscle thermogenesis. Introduction of adrenaline and noradrenaline caused shifts in muscle heat production only in hyperthyroid animals. Total heat production increased in this case by 6.3±2.87 mcal/sec/g, that is by 26.8%. A close correlation existed between increase of rectal temperature, caused by catecholamines, and muscle thermogenesis. In control and hypothyroid animals this connection was absent. Figures 3, tables 3, references 20: 14 Russian, 6 Western. [240-1015]

UDC 612.842.6-06:613.72

THE RELATIONSHIP BETWEEN INTRAOCULAR PRESSURE AND BLOOD PRESSURE IN THE OCULAR ARTERY AND THE RETINAL CAPILLARIES IN ATHLETES UNDER TRAINING CONDITIONS

Moscow VESTNIK OFTAL'MOLOGII in Russian No 1, 1980 pp 31-33 manuscript received 20 Mar 1979

KORABLEV, A. F.

[Abstract] The study involved 227 athletes ranging from 12 to 50 years of age, with 129 females and 98 males divided into categories of speed, endurance and coordination being required to undertake vigorous exercise, then being subjected to pressure and light sensitivity tests. Statistically significant variations before and after load were observed in the threshhold of light sensitivity and in the general effects of physical load on endurance. The relationship between intraocular pressure and blood pressure was regarded as a criterion for the reaction of the organism in general and the eye in particular in assessing the possible effects of physical exercise for athletes. Endurance and coordination motions were found to be prefereble. Figures 4, 1 table, references 10 in Russian.
[285-12131]

UDC 615.917'262-053

AGE FACTORS IN EXPERIMENTAL ALCOHOLISM OF RATS OF BOTH SEXES

Moscow FARMAKOLOGIYA I TOKSIKOLOGIYA in Russian No 2, 1980 pp 166-169

ANDRONOVA, L. M., and BARKOV, N. K., Laboratory of Narcotic Pharmacology, Central Institute of Forensic Psychiatry imeni Prof. V. P. Serbskiy, Moscow

[Abstract] Studies were conducted on the formation of alcoholic habits with respect to age and sex, employing outbred white rats divided into sexually immature (81-86 g) and mature (227-257 g) groups. The results showed that on the basis of ad libitum access to 8% ethanol preference for alcohol forms earlier in the immature rats and alcohol consumption exceed 2-3 fold that seen in the adult animals. In addition, alcohol preference is established earlier in the young female rats than in the males. On aging alcohol consumption decreases; however, adult females with an established preference for alcohol consumed greater quantities than the adult males. The greater susceptibility of the younger animals to alcohol is ascribed to dominance of an 'adrenergic profile' which favors more rapid alcohol metabolism. Tables 1; Figures 1; References 14: 5 Russian, 9 Western.
[[illegible]]

THE AVIATION PSYCHOLOGIST AND THE FLIGHT SIMULATOR

Moscow PRAVDA in Russian 30 Nov 79 p 6

[Article by Nonna Oreshina]

[Text] Man and machine--living flesh and passionless metal. Problems in their complex collaboration have always existed: man has persistently sought optimum solutions, adapted the machine to himself and himself to it. This has occurred clearly and difficultly in aviation, in military aviation. Characteristic of today is a complex but regular connection: psychologist-designer-pilot. Our story is about an aviation psychologist.

The steadily buzzing semi-darkness of the training room. On the wall glows a pearl-gray screen. And, as if cutting it, slabs of runway rush along and the white pointer of an axial line is thrust into the horizon.

An experiment is going on.

The simulator cabin of a single-seat airplane without a canopy, in the red glow of the instruments seems strangely bare. And a pilot without a crash helmet and the patches of sensors on his hands and face that whiten in the semi-darkness, and the wires that intertwine weightlessly. Special goggles that register the direction of his glances and the path of eye movement make the pilot resemble a strange inhabitant of another planet--a plastic semicircle hangs over his face and the smoked lenses hardly gleamed. The thin crimped tube and the lightguide in a coil run into a motion-picture camera mounted on the side of the cabin.

The pilot adjusts his headphone, touches the microphone prong attached to the corner of his mouth, "Zero ready, shall we repeat the approach?" The experiment leader listens attentively at a control panel in an adjacent room.

His chin and cheek-bones become firm, motion becomes scanty and precise: even in simulated flight the pilot feels stress, and not just because the

the process of control is complicated. The machines reproduce and associate a variegated gamut of real airborne sensations and on the consciousness of responsibility for the experiment is superposed the ordinary, watchful circumspection in flight.

Now the screen in front of the windshield of the cabin is still and dark--the landing must be made by instruments. And only when the airplane flies through a middle marker locator does the screen light up reassuringly brightly, as if dense clouds had been removed from the cockpit canopy, revealing the ground, permitting the pilot to remove his glance from the pointers of the instruments and determine the situation by a simple human glance.

The pilot and the airplane... How are their inter-relationships formed? What is the pledge of flight safety? Why can a pilot commit an error even when the equipment is in good order and he has sufficient experience? To what degree is it necessary to replace man, entrusting the automatic piloting and navigation to automatic systems? These questions also led me to Vladimir Aleksandrovich Ponomarenko, doctor of medical sciences, one of the leading specialists in the area of aviation engineering psychology, a science in which the directions of research are only being determined.

Carefully, trying not to distract the pilot, we go from the training room to the adjacent room where the screen of a TV set is lighted and young associates of the research group--engineers, physiologists, psychologists, etc., sit at the control panel and registering apparatus.

"The innovations must include knowledge of man, of his psychic and physical possibilities," says Vladimir Aleksandrovich. "Flight can be made safe only by creating maximum psychological comfort, so that the pilot in his workplace does not simply feel easily, but thinks easily..."

In aviation it is more complicated to introduce novelty than anywhere else, although it is precisely here that sharp technical thoughts are concentrated precisely and many scientific discoveries of the age cause repercussions in each successive aircraft design. But the changes involve not simply improvement of the aircraft. Thus, aboard contemporary aircraft, to reduce the take-off and landing minima, piloting on complex trajectories and other purposes, automated control systems have been introduced that give a gain in precision and an evident alleviation of the work.

But automation has as it were removed man from the machine. The close connection of man with the aircraft has been destroyed. But in any, even the most "automated" flight, a fine, still not analyzable, "feeling of the aircraft" is required--a state in which the man feels the machine in flight as his own body, when the controls seem to be an extension of his hands and the rhythm of the working engine becomes the beat of his heart, when the idea of spatial position, the determination of his place in the air is inseparable from consciousness.

How is the boundary, beyond which automation changes from an ally to an out-of-place guardian, to be found?

"Technology must support man without interfering with his strong aspects, however. The aircraft is only a tool of labor by means of which the pilot solves tasks presented to him, and in any design it is necessary to create conditions worthy of the personality of the pilot," said V. A. Ponomarenko to me the first time we met. This careful attitude and high respect for the personality of the pilot was born in Vladimir Aleksandrovich as early as the years when he was graduated from the Academy of Military Medicine and entered the position of physician of an aviation unit. And he soon understood that the aviation physician must not only concern himself with practising medicine but also study pilot activity that occurs in conditions of the constant effect of stress factors. He strove to understand peculiarities of psychic processes in flight, to penetrate the stressed work of the mind, the specifics of flight set under conditions of a shortage of time and the creation of constant risk. But to do that it was necessary to know how man in flight perceives the information arriving from the instruments and the environment, how the memory and thinking function. It was necessary to understand which feelings dominate in flights at limitingly low attitudes and in the stratosphere.

To err is human. But in flight error acquires too high a price. Why were a pilot's actions wrong? Where is the reason, in the method of instruction, in the design of the machine or in the possibilities of man? V. A. Ponomarenko and Doctor of Psychological Scients N. D. Zavalov were among the first to demonstrate that error often arises because of inadequate coordination of the technical means with the possibilities of man, and this is not the "personal" but the "human" factor.

To correctly set up a laboratory experiment and model it for flying is an art. But even the most improved simulator cannot give the totalities of feelings that accompany real flight: there are no instrument signals--of sounds, overloads, of circumstances aboard, there is not that high stress that sometimes mobilizes and at other times paralyzes a pilot.

The flight experiment is the most critical critical stage of the tests. One prepares for it carefully and proceeds to it when the possibilities of simulators have been exhausted.

Resounding vibration, the sliding heaviness of accelerations, the massive rumble of engines. The fuselage of a heavy airplane, booming and rattling, encumbered by control and measuring apparatus mounted on scaffolding and shelves, and the cabin, opened wide by windows into the blue, was squeezed by panels of instruments and seems closer than usual--between the pilots' seats sits an operator, and the lightguide hoses creep toward the motion-picture apparatus. Ponomarenko, as the head experimenter, stands with the cabinet of a portable communications panel in his hands behind the armchair of the aircraft commander, trying to see the indications of the instruments and the faces of the pilots on the right and left simultaneously. His voice resounds persistently: "What have you? Are all the engines working? And the second"..."

In the answers of Commander Vladimir Aleksandrovich sounds something watchful, as he looks at the red light signalling a failure. Why doesn't the experienced pilot notice it?

"The rpm's of the second are dropping and the oil pressure has fallen," he reports. There is stress in the tone of his voice. Registered on the encephalogram are acceleration of the pulse and respiration, movements of the wrist and fingers of the hands... After 2 long seconds: "The second has failed."

"What prevented you from recognizing the signal rapidly?"

The pilot was embarrassed:

"According to the control I felt it pull to the left, but I didn't expect you to disconnect it without warning... It was my fault, I didn't watch the indicators."

But if not just one, but most of the pilots in such an experiment do not perceive signals with the necessary rapidity, it means it is ineffective and although placed in the field of vision it is not in the field of attention and it is necessary to change its place, to make it a blinker, to bring it out on a display.

To sum up, if we analyze the observations, magnetic tape recordings, the data of oscillographs, [illegible] tapes, and instructive motion-picture frames, it can be understood how decisions are predicted under conditions of a shortage of time, where error is hidden in the logic of momentary discussions, which methodical recommendations or design solutions can help.

I looked at the concentrated face of Vladimir Aleksandrovich, and unwillingly in my memory surfaced his tales about pilots with whom he has risen in the air many times in fighters and heavy aircraft, with whom he has conducted experiments fraught with risk and whom in scientific works, in accordance with the generally accepted practice, he had to call them "pilot K," "pilot M."...

Thanks to the security provided by those whose workplace is the boundless fifth ocean, an engineering psychologist with an alloy of profound medical and aviation knowledge, hardly that of a designer, seeks and finds ways to introduce into the metal very fine human qualities. But, in penetrating the secrets of flight mastery, the investigator has to as it were be introduced into the spirit of the pilot. And bloodless progress is not always painless... How careful and precise must be the hands, how balanced and stable the convictions, what tact the scientist must have who takes upon himself the right of responsibility for flights which others make.

[illegible]

[illegible]
CSO: [illegible]

UDC 613.68:612.766.1:612.821-057:359.1

NERVOUS TENSION AND STRESS IN RELATION TO PERFORMANCE OF DUTIES BY SEAMEN

Moscow VOYENNO-MEDITSINSKIY ZHURNAL in Russian No 1, 1980 pp 51-54

SOLODKOV, A. S. and LOBZIN, V. S.

[Abstract] The complex gear carried on modern ships has increased the load on the functions of the central nervous system, the analyzers, and the organism as a whole, thus also enhancing nervous tension and stress (NTaS). Three types of NTaS are isolated: Emotional stress, which can be either negative or positive; hyperstimulation of higher nervous activity or an information overload; and physiological NTaS due to the hypokinesia, partial sensory isolation and perceptual deprivation associated with prolonged ship cruises, particularly submarine cruise. Resistance to NTaS can be increased through proper functional training. Other ways of maintaining a high level of performance of duties in seamen include the assurance of functional and psychological compatibility of a ship's crew. Functional compatibility presupposes a uniform level of training and similar parameters of mental and physiological functions and processes. Psychological compatibility refers to harmonious interpersonal relationships within an entire team performing a given task. It has been observed during prolonged cruises that individuals develop a more acute desire for privacy and the number of interpersonal conflicts increases. This points to the need to allow for psychosocial affinities when selecting a ship's crew. NTaS is generally accompanied by various vegetative disorders. In daily practice, neurotic reactions and the attendant shifts in functions of the organism should be distinguished from physiological changes due to unfavorable environmental (weather) factors, so as to facilitate the adoption of appropriate preventive measures. References 13: 12 Russian, 1 Western.
[250-1386]

UDC 615.471:616-073.65-71

ANALOG MODEL OF INTERACTION OF THE HUMAN BODY-TEMPERATURE SENSOR-ENVIRONMENT SYSTEM

Moscow MEDITSINSKAYA TEKHNIKA in Russian No 4, Apr 1979 pp 17-21 manuscript received 14 Sep 78

PODDUBNYY, A. P., Moscow Engineering-Physics Institute

[Abstract] A simply analog model is described for measuring the interaction of the human body with a temperature sensor and the environment. The temperature measurements were divided into three main types: surface body temperature, intracavitary temperature measurement and temperature

measurement in semiclosed regions. The given model provides good description of the real interaction between the temperature sensor and the human body. The analytical expressions which describe the model permit one to determine the real dynamic parameters of the temperature sensor and human body system by several samples of the transition characteristic. Figures 3; references 2: 2 Russian.
[9844/0345]

QUANTITATIVE ESTIMATION OF THE LABOR OF THE OPERATOR

Moscow MORSKOY SBORNIK in Russian No 1, 1980 pp 42-45

OKSENGENDLER, G.

[Abstract] The complexity of the labor of the human operator is a major factor in the capability of a "man-machine" system. Estimation of that complexity yields the data needed to streamline the labor and training of the operators. Since the operator's labor is chiefly mental, its complexity depends mainly on the magnitude and nature of the load on the various analyzer systems of the human organism (visual, auditory, motor, etc.). It is shown in this connection that a time-and-motion study of the various functions performed by the operators in handling specific elements of the control system such as measuring instruments, mnemonic circuits, levers, handles, switches, etc. serves to compute the frequencies (probabilities) of each of these operations. A corresponding formula is presented. The index H of discrete most important operations, serving to compare their degree of complexity, is discussed. It is shown that the degree to which an operation is stereotyped is another criterion of its complexity. The more stereotypical an operation is, the less complex it is. Such qualitative factors as emotional tension can be minimized if the operator is trained in all the possible variants of his operations. On the whole, the use of statistical indexes serves to quantitatively estimate the complexity of control functions and to solve practical problems of enhancing the reliability of performance of various shipboard specialists.
[225-1386]

UDC: 616.89-08-039.76(049.32)

NEW BOOK DEALS WITH REHABILITATION OF MENTAL PATIENTS

Moscow SOVETSKAYA MEDITSINA in Russian No 12, 1979 pp 101-102

[Review by Docent P. A. Makkaveyskiy and K. A. Kamenkov, candidate of medical sciences (Leningrad) of the book "Reabilitatsiya psikhicheski bol'nykh" by M. M. Kabanov, Izdatel'stvo Meditsina, Leningrad, 1978, 232 pages]

[Text] This monograph deals with rehabilitation of mental patients. However, as can be seen from the text, its contents are more profound: there is an attempt to consider the rehabilitation problem as a whole, and in particular rehabilitation of mental patients. The book does not presume to provide exhaustive answers and does not preclude discussion.

It is validly stressed in the Introduction that "... the conception of rehabilitation does not yet have sufficiently distinct and generally recognized theses. It has encountered on the road of its development quite a few difficulties, prompted debates and various, sometimes contradictory, judgments pertaining to terminology, methods and certain basic issues."

Chapter 1 traces the development of the concepts of rehabilitation in psychiatry, primarily from the standpoint of social relations: "society and the mental patient," "society and rehabilitation." A strict medical-historic approach and broad coverage of the discussed aspects of the problem blend well with entertaining presentation.

Chapter 2 sheds light on the main aspects of the problem, the experience of foreign and Soviet psychiatrists in rehabilitation of mental patients in the hospital and extramural conditions. Data are cited from the foreign literature that is little known to us. This chapter can be rather arbitrarily called a literature survey, since the author skillfully weaves into the canvas of the two main topics of the chapter (intramural and extramural rehabilitation) some of his own thoughts, judgments, generalizations and suggestions concerning several established concepts: "therapeutic environment," "therapeutic community," "medical deontology in rehabilitation," etc. The methodological value of these unique insertions, which are organically related to the text, lies in the elements of universality, the possibility of extrapolation thereof to several other medical disciplines.

In Chapter 3, "Basic Themes of Rehabilitation," the author emerges as a theoretician oriented toward rehabilitation, not only in psychiatry but other branches of medicine. Indeed, the principles of rehabilitation of mental patients evolved by M. M. Kabanov are methodologically suitable for rehabilitation programs for patients with various diseases. "Only man can be rehabilitated, but as we know animals can be treated [as well as man]." In the statement M. M. Kabanov makes to make a distinction between any rehabilitation program and treatment in the usual sense of the word. This thesis is also very important from the practical point of view, since clinicians sometimes reduce the complex process of rehabilitation merely to therapy, or else they equate the two. Further, it is validly stressed in the book that "appealing to the patient's personality is the pivotal content of all rehabilitation measures, all methods of handling him." In this chapter, much attention is given to substantiation and disclosure of the substance of the principles involved in the approach to rehabilitation of mental patients, and this is unquestionably a perceptible step forward, both in theory and on the road to practical adoption of the rehabilitation direction in the work of public health and social security institutions. Let us briefly list these principles: 1) active involvement of the patient himself in the therapeutic and rehabilitation process, the partnership principle (physician--paramedical and nonmedical personnel--the patient, his relatives and immediate surroundings); 2) the principle of versatility (multiple levels) of action (treatment, measures) to implement the rehabilitation program; 3) the principle of unity of psychosocial and biological treatment methods; 4) the principle of steps [stages] (transitions) in efforts applied (action [treatment], measures). This principles constitute (or should constitute) the program of action in rehabilitation, which goes far beyond the framework of psychiatry.

M. M. Kabanov is acutely aware of the inadequacy of a purely medical model of rehabilitation. He expresses his desire to make a broad formulation of the rehabilitation problem in each chapter through original judgments about rehabilitation as a concept, a system. This is manifested, in particular, by his comment concerning the theoretical invalidity of the desire of many authors to limit the concept of "rehabilitation" to such definitions as "vocational" or "sociovocational" rehabilitation. The author observes that, when dealing with rehabilitation, "social" rehabilitation should always be implied. It is quite arbitrary to single out specific aspects or stages of rehabilitation as related to practical purposes. Thus, WHO arbitrarily divides rehabilitation into three stages: medical, occupational and social. On this basis, M. M. Kabanov developed an original scheme of rehabilitation of mental patients, which he also broke down into three stages: restorative therapy, readjustment and rehabilitation (in the direct sense of the word). In a diagram (page 47), he formulates the contents of each stage, with recommendation of the preferred organizational form of psychiatric and social aid.

The fourth chapter deals with organizational and methodological aspects of rehabilitation of mental patients. The author makes a comprehensive analysis of the results of organizing a new type of department in a psychiatric clinic, the rehabilitation department. Psychiatrists and administrators of therapeutic and preventive institutions will find much useful material, since the author provides a very good description of the process of organizing such a department as seen from the inside, rather than on the basis of external features, shedding light on the multilevel work that has been done by a team headed by M. M. Kabanov for many years. We were impressed by the following lines: "The work started with retraining of the personnel.... The retraining proceeded, so to speak, under the slogan: 'The patient is not an object, but an equal partner in treatment.' While overcoming the considerable skepticism of some physicians and nurses ... we finally achieved what was the most important thing, teaching the personnel to see in the mental patient an individual [personality] with his numerous distinctions reflected in different everyday situations."

The main element in this chapter is the elaboration and description of experience in using differentiated therapeutic regimens: protective, sparing [conservative], activating, as well as differentiated modes of observation (restrictive, differentiated, "open door," partial hospitalization).

The uneven size of the book chapters is striking. The last, fifth chapter constitutes half the monograph. It provides comprehensive evaluation of the efficacy of therapeutic and restorative action and measures, methods of clinicopsychological, specifically sociological, sociopsychological and clinicocatamnestic studies, which confirm the theoretical theses of the author on the basis of adequate factual material. This chapter is intended primarily for psychiatrists, psychologists and psychotherapists.

It is repeatedly stressed in the monograph that there is an acute need to train personnel for the rehabilitation service; there is discussion of a number of timely issues pertaining to training of specialists on the highest and intermediate levels in the area of general and special questions of rehabilitation; it is stressed that this area of work must be refined. At the same time, it should be noted that the author did not make reference to data pertaining to recertification of the disabled in specialized psychiatric VTEK [medical commissions for determination of disability], and the author failed to submit even a brief analysis of the statistics on rehabilitation of those disabled as a result of mental illness. There is no mention at all of data concerning total and partial rehabilitation, overall index [indicator], etc., which have already been used for a long time in VTEK practice referable to preparation of statistical data.

In the next edition of the book, the author should be advised to shorten the second and fourth chapters, as well as some sections of the fifth, and to add subheadings. It would be desirable to have him provide more details concerning rehabilitation of mental patients outside the hospital at the final stage of rehabilitation, and about its efficacy.

The book by M. M. Kabanov will be instrumental in further development of the rehabilitation direction in public health and social security, and it will be very helpful to physicians in different specialties.
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CERTAIN LEGAL QUESTIONS RELATED TO COURT-PSYCHIATRIST TESTIMONY AND FORCED TREATMENT OF THE MENTALLY ILL WHO HAVE COMMITTED SOCIALLY DANGEROUS ACTS

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[Abstract] The two positions that (1) an expert should or (2) should not make a determination on the responsibility of a mentally ill patient are considered. The author suggests that an expert be the one to make the determination since, as far as investigative bodies and courts are concerned, the important thing is not the label attached to a mental disorder but the determination as to whether a person in a given situation is capable of understanding and controlling his actions. Soviet precedents and legal guarantees of the rights of the mentally ill are mentioned in relation to this problem. References 13 in Russian.
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